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STRUCTURE and PROJECTIONS of the HUMBOLDT COUNTY ECONOMY: ECONOMIC GROWTH VERSUS ENVIRONMENTAL QUALITY

by

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CALIFORNIA AGRICULTURAL EXPERIMENT STATION
GIANNINI FOUNDATION OF AGRICULTURAL ECONOMICS

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SUMMARY AND CONCLUSIONS

Humboldt County's economy is structured primarily around its natural resource base. The geographical characteristics of the county have made possible the development of a very significant forest products sector, producing 25 percent of the state's lumber output, as well as a sizable seafood processing industry and to a lesser extent an agricultural sector (primarily dairy products). These sectors of the economy contribute significantly to the county's total exports. Employment within these natural resource based sectors is 12,040, or 31 percent of the county's total employment. Continued reliance on these key sectors depends on the ability of the natural resource base to sustain the present rate of use, recognizing institutional, environmental and economic constraints. It is indicated that the present rate of harvest of the forest resource is in excess of the sustainable yield level. Also, fishery resources, particularly salmon and dungeness crabs, two of the highest valued species, have shown marked declines in production. This raises doubts as to the future viability of these resources at the present rate of harvest and the eventual impact on county employment and income. Humboldt County, at present, has an annual unemployment level of 7.7 percent, with highest levels occurring during the winter months. This report develops an input-output model of the Humboldt County economy to provide a basis for measuring the trade-off between alternative courses of action concerning issues of economic development and environmental quality.

Specifically, we make 1980 projections of the county economy with alternative levels of output, final demand, and technology for natural resource sectors likely to be affected by environmental decisions. Some results of these series of projections are:

1) Without increases in labor productivity and under conditions established in the 1980 base model (see Table 16), a 22 percent decline in the forestry products industry output (905 MBF) from 1969 harvest levels is more than offset by increases in output of the other economic sectors with a resultant increase in employment to 43,274, from the 38,531 in 1969 (about 13 percent), and a slight decrease in average income per employee from $10,090 in 1969 to $9,844 in 1980 (1969 prices). Total household income is projected to increase to $426 million from the 1969 level of $388.8 million.

2) Allowing for technological change, employment is projected to fall to 31,797 (about 17 percent), but with an increase in average income per worker to $13,397.

3) If forestry harvest declines to 700 MBF the 1980 levels of employment, with and without technological change, would be 29,525 and 40,392, respectively. Average income per employee, with and without technological change, would be $9,975 and $13,646, respectively.

4) If more optimistic forestry harvest is projected (1,094 MBF) for 1980 then the levels of employment, again with and without technological change, would be 33,769 and 46,202, respectively. Average income per employee would follow the same pattern as established above. Accordingly, the rate of technological change will be at least as important as changes in the output of the forest industry in determining employment and income per worker.

5) If fisheries output were to drop 50 percent from the 1980 projected level, county income would drop by $12.5 million while employment would decrease by about 1,000. If fisheries output should exceed the 1980 projection by 100 percent then there would be a resultant increase in county income of $25 million and an increase in employment of 1,600 (with technological change).

6) If the recreation-tourism industry should fail to reach 1980 projections and remain at the 1969 level, the county income would be $15 million less than the 1980 projection and employment about 1,800 less. If this industry growth should exceed the 1980 base projection (by 100 percent) then county income would increase by about $29 million and employment (with technological change) by about 3,000 over the base model.

The implications of these projections to 1980 are that output increases in nonlumber sectors of the Humboldt economy will likely offset decreases in lumber output only if labor productivity remains unchanged. With the more likely assumption that technological changes will occur, employment can be maintained at 1969 levels only with increased state and federal spending and/or new industries entering the economy. If these conclusions are warranted, then local planners and agencies face challenging problems of adjusting local facilities and services to a declining population base.

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STRUCTURE AND PROJECTIONS OF THE HUMBOLDT COUNTY ECONOMY: ECONOMIC GROWTH VERSUS ENVIRONMENTAL QUALITY

INTRODUCTION

Humboldt County is located on the North Coast of California, approximately 285 miles north of San Francisco. It's primary industry is lumber, although other natural resource based industries -- agriculture, fisheries, and tourism -- are also relatively important in the local economy. Although transportation facilities into the region have been markedly improved in recent years, the county is still somewhat isolated from the population and industrial centers of the San Francisco Bay Area. The Coastal mountain range also inhibits trade with the rich agricultural Sacramento Valley.

Because of its rich endowments of natural resources, the county has assumed an importance to the state and nation disproportionate to its relatively small population of approximately 100,000 people. In recent years, the county has become the geographic battleground for a number of environmental issues -- the appropriate level of cut and reforestation of private and public timber lands, the establishment of a National Redwood Park, the future use of several major north coast rivers as sources of supply for the California Water Plan, and the related issue of the maintenance of scenic wild rivers.

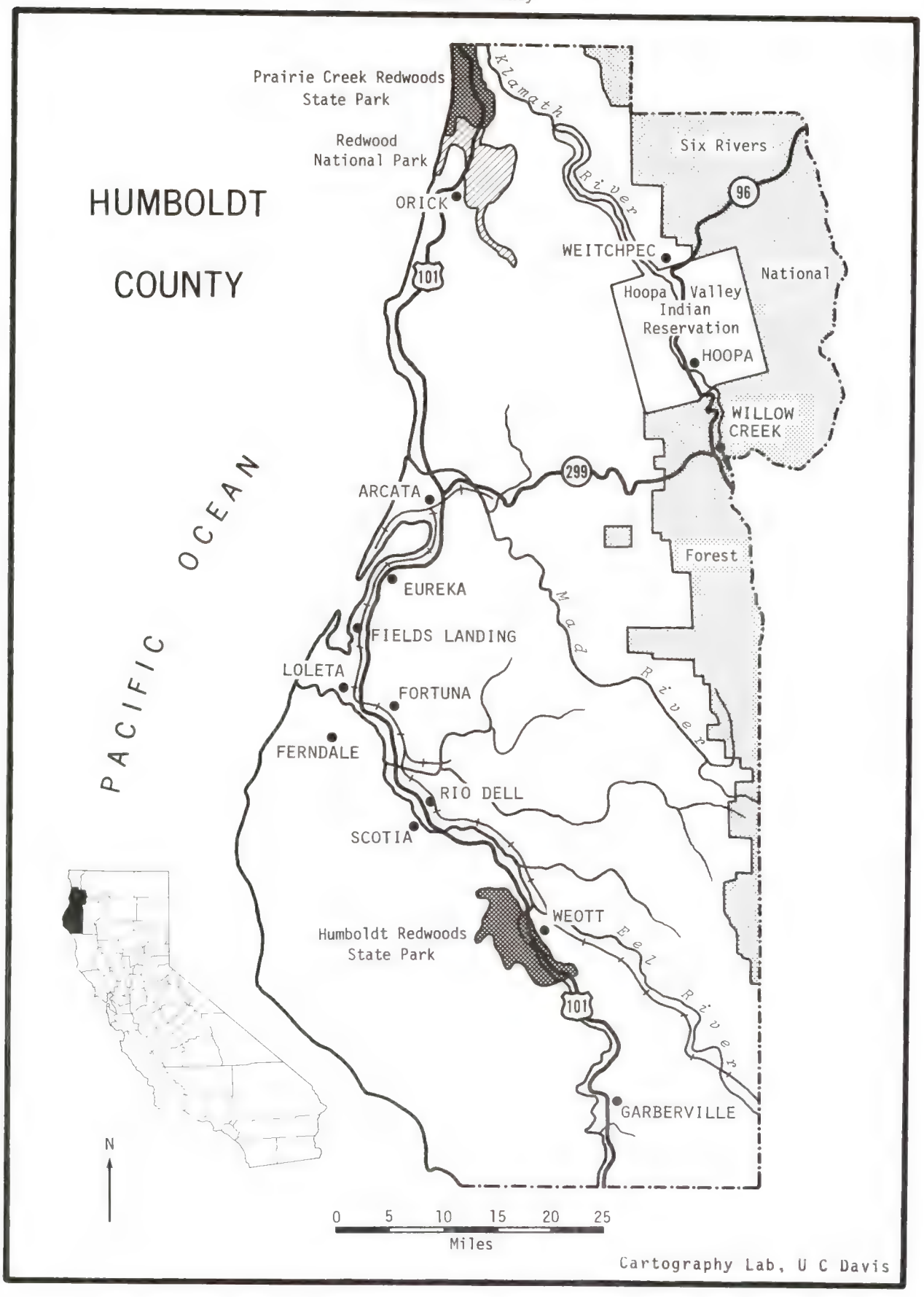
Humboldt County was selected for study because it seemed to contain in rather bold relief the issue of environmental quality versus economic growth. It was hoped therefore that examination of this local economy in some detail would be useful at two levels: (1) to private and public decision-making units in Humboldt County; and (2) as a relevant case study for public policy decisions involving issues of environmental quality and economic growth elsewhere in the general economy.

A Brief Description of the Geography, Resource Base and Economy of Humboldt County

An overall impression of the geography in Humboldt County can be gained from examination of Figure 1, which contains the county's two largest cities, Eureka and Arcata. The only intensive agriculture in the county is also

FIGURE 1

Map of Humboldt County



located near Humboldt Bay. Cultivated agriculture, centered around dairying, is limited largely to the valley floors formed by the flood plains of the Eel and Van Duzen rivers to the south of Humboldt Bay, and the Mad River to the north of the Bay. The remainder of the county is sparsely populated, and suitable primarily for timber, with some areas adapted to grazing (mainly beef cattle) or to joint use for grazing and timber. Table 1 gives a somewhat more precise breakdown of Humboldt County land use, again showing the dominance of forest land: approximately 82 percent of the county land area is in forest (68 percent nonfederal and 14 percent federal). Table 2 shows a more detailed breakdown of nonfederal land use according to the Soil Conservation Service land capability Classes I through VIII. Again, the relatively limited amounts of land suitable to cultivation (classes I-IV) and the dominance of forest land is evident.

Given the timber resources of the county it is not surprising to find that the forest products industry dominates the local economy. The population growth in the county has been closely related to the growth of the lumber industry. Figure 2 shows the slow buildup in pre-World War II county population, reaching about 45,000 in 1940. The World War II and postwar boom in construction led to a corresponding lumber and population boom in Humboldt County. However, in the 1960's the slowdown and the decline in lumber activity led to a similar population trend. As will be explained in more detail later, the slowdown in the lumber industry was due both to a reduction in demand for lumber products (a decline in new housing primarily) and to a decline in the supply of lumber in the county. Starting in 1968 the county population dropped significantly and in 1970 had reached about 98,000, nearly 10,000 below the peak in 1962-64.

Table 3 shows the total personal income, county population, and per capita income of Humboldt County from 1950 to 1970, with comparisons to the state of California. In the early 1950's the Humboldt County income was approximately equal to the state average. By the early 1960's it had declined to about 80 percent of the state average and has continued to fluctuate around that level.

Table 4 presents a somewhat more detailed breakdown of the Humboldt County economy, showing employment, gross output (equal to gross sales for most industries), and the value added (gross sales minus purchases from other industries) in 1969, the base year for this study. In terms of

TABLE 1

1967 Land Use in Humboldt County by Major Category

Land use category	Acres	Percent of total area
Forest	1,549,000	67.74
Federal (noncropland)	343,162	15.01
Commercial forest	317,000	13.86
National Forest	292,000	
Bureau of Land Management	53,000	
Bureau of Indian Affairs	72,000	
Other	26,162	1.15
Cropland	70,220	3.07
Pasture	28,205	1.23
Range	250,596	10.96
Urban and built up	20,314	0.89
Small water areas	5,088	0.22
Other	20,057	0.88
TOTAL	2,286,642	100.00

Sources: U.S. Soil Conservation Service [1970, pp. 15-18]. Management of Federal Commercial Forest From: Oswald [1968, Table 2].

TABLE 2

Nonfederal Cropland, Pasture and Range, and Forest by Land Capability Classes[a/]

Land class	Total acres in inventory	Total acres cropland	Total acres pasture and range	Forest	
				Total commercial acres	Total acres
I total	9,289	8,377			
II e	637				637
w	64,919	28,336	24,781	5,695	6,332
Total II	65,556	28,336	24,781	5,695	6,969
III e	38,283	13,961	11,107	11,391	11,391
w	10,897	1,861	3,417	3,796	3,796
s	13,198		9,402	3,796	3,796
Total III	62,378	15,822	23,926	18,983	18,983
IV e	60,962	5,585	17,086	18,986	35,556
w	22,391	10,239	4,557	7,595	7,595
Total IV	83,353	15,824	21,643	26,581	43,151
VI e	1,314,882	1,861	174,279	1,044,087	1,138,742
s	72,936			72,139	72,139
Total VI	1,387,818	1,861	174,279	1,116,226	1,210,881
VII e	292,138		33,033	212,619	258,193
s	159				159
Total VII	292,297		33,033	212,619	258,352
VIII e	9,472				7,649
w	7,915		1,139	1,899	2,218
Total VIII	17,387		1,139	1,899	9,867
GRAND TOTAL	1,918,078	70,220	278,801	1,382,000	1,549,000

(Continued on next page)

TABLE 2 (Con't.)

a/ Definitions of Land Capability Classes:

Land Suited for Cultivation and Other Uses

I -- Soils in Class I have few limitations that restrict their use.

II -- Soils in Class II have some limitations that reduce the choice of plants or require moderate conservation practices. They are suited to cultivated crops, pasture, range, woodland, or wildlife.

III -- Soils in Class III have severe limitations that reduce the choice of plants or require special conservation practices or both. They are suited to cultivated crops, pasture, range, woodland, or wildlife.

IV -- Soils in Class IV have very severe limitations that restrict the choice of plants, require very careful management, or both. They are suited to cultivated crops, pasture, range, woodland, or wildlife.

Land Generally Not Suited for Cultivation

VI -- Soils in Class VI have severe limitations that make them generally unsuited for cultivation. They are suited largely to pasture, range, woodland, or wildlife.

VII -- Soils in Class VII have very severe limitations or hazards that make them generally unsuited for cultivation. They are suited to grazing, production of forest products, recreation, or wildlife.

VIII -- Soils in Class VIII have limitations that preclude their use for commercial plant production and restrict their use to recreation, wildlife, water supply, or aesthetic purposes.

Subclasses (type of restrictions)

e: Erosion

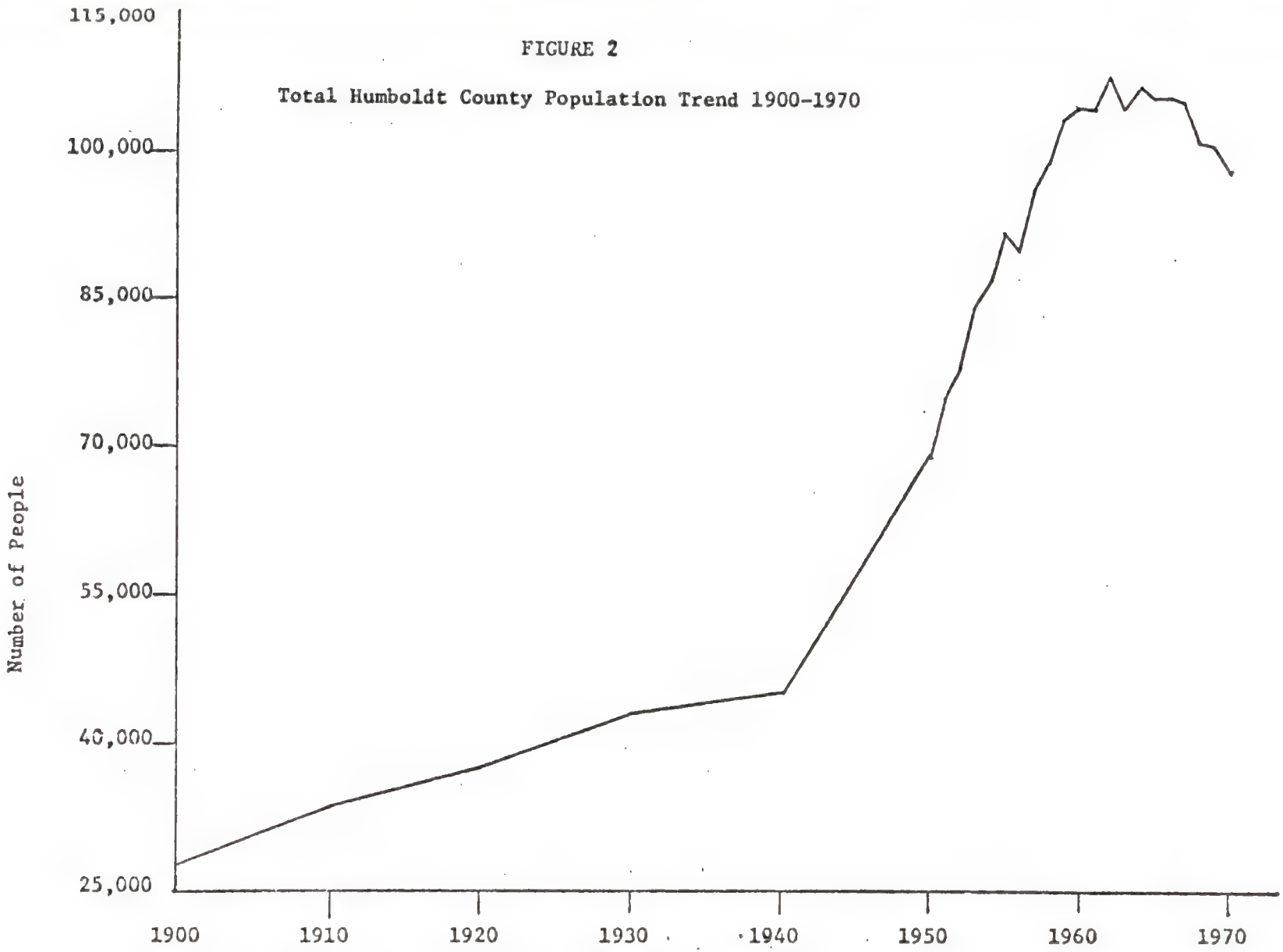
w: Wetness

s: Soil limitation

Source: U.S. Soil Conservation Service, Report and General Soil Map Humboldt County, California, Soil Conservation Service, Ukiah, 1967, p. 18 (unpublished).

FIGURE 2

Total Humboldt County Population Trend 1900-1970



Sources: California Statistical Abstract 1970
U.S. Bureau of the Census

TABLE 3

Total Personal Income, Population, and Per Capita Income, Humboldt County, 1950-1970, with California Comparison

Year	Humboldt County			California per capita income	Humboldt County per capita income as a percent of California per capita income
	Total personal income ($000)	County population	Per capita income		
1950	$124,862	69,241	$1,803	$1,840	98.0
1955	205,759	91,780	2,242	2,324	96.5
1957	202,569	96,900	2,091	2,511	83.3
1958	209,292	99,000	2,114	2,527	83.7
1959	239,996	104,310	2,301	2,681	85.8
1960	232,196	104,892	2,214	2,709	81.7
1961	231,030	104,920	2,202	2,791	78.9
1962	240,990	107,900	2,233	2,902	76.9
1963	250,869	104,920	2,391	3,003	79.6
1964	271,331	107,100	2,533	3,139	80.7
1965	288,821	106,300	2,717	3,258	83.4
1966	300,963	106,100	2,837	3,459	82.0
1967	291,860	105,900	2,756	3,636	75.8
1968	314,093	101,500	3,095	3,941	78.5
1969	338,798	101,100	3,354	4,209	79.7
1970	352,300	98,211	3,587	4,439	80.8

Source: California Statistical Abstract: 1961-71.

TABLE 4

1969 Employment, Gross Output, and Value Added By Major Industry Groups, Humboldt County

Sector	Employment			Gross Output	Value Added
	Insured	Non-insured	Total	($000)	
Agriculture	391	1,858	2,249	$ 34,265	$ 11,615
Fishing & Mining	645	367	1,012	24,258	12,898
Forest Products	8,779		8,779	208,754	138,102
Other Industry	931	949	1,880	38,213	18,199
Transportation	906	451	1,357	20,824	14,672
Trade	7,559	1,695	9,254	115,612	88,817
Services	2,963	3,337	6,300	50,867	35,456
Local Government[a/]	8	2,092	2,100	42,797	29,503
Nonlocal Government[a/]		5,600	5,600	76,740	40,182
Humboldt County Total	22,182	16,349	38,531	$612,330	$389,444

a/ For government sectors, Value Added equals wages and salaries of employees.

Sources: Insured employment data from California Department of Human Resources [unpublished]. Total employment data, gross output and value added data drom input-output flow table developed later in this report.

employment, the forest products industry employed 8,779 people in 1969, or about one-quarter of county total employment. In terms of gross value of output and value added, the forest products sector is more dominant, with 34 percent and 35 percent of the respective county totals. The employment in the forest products industries is almost equal to that of all "trade" combined (defined broadly here to include wholesale and retail trade, communications and utilities, finance and insurance, and real estate), and exceeds that in services and in all categories of government combined.

Current Economic Problems in Humboldt County

The general economic problem of Humboldt County is often characterized as one of excessive dependence on one industry, lumber, (or more accurately, the forest products industry), which tends to be rather cyclical in nature over time, and highly seasonal in terms of employment. Unfortunately, the other natural resource based industries of the county (agriculture, fisheries and recreation-tourism) tend to accentuate the seasonality of employment. During the summer months logging activity is in full swing, coinciding with the peak seasonal labor periods of agriculture and fisheries. In addition, the summer vacation period is when most tourists visit the county for fishing, hunting, and enjoyment of the scenic Redwood Parks and ocean beaches.

Tables 5 and 6 document the above generalizations; however, the sector definitions in these tables differ slightly from those used in constructing the input-output models and other tables in this report. Table 5 shows the annual average estimated employment, unemployment and labor force in Humboldt County from 1959 through 1970, indicating that the annual average unemployment rate has remained high throughout the decade of the 1960's. The data show a downward trend, with sizeable annual variations in employment in the lumber industry over this period. The level of employment in construction is also highly variable from year to year. Together, the lumber and construction industries account for the major instability in county employment from year to year. The years of highest unemployment are those in which lumber and construction activity are low (e.g., 1961, 1967, and 1970). Partially offsetting the decline in lumber employment has been a relatively steady increase in services and government employment as well as some increase in the trade sector. Thus, the general level of total employment in the county has not changed significantly over the decade, remaining usually in the 36,000 to 38,000 range.

TABLE 5

Estimated Employment, Unemployment and Labor Force
Eureka Labor Market[a/]

	Annual averages 1959 through 1970											
	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
	thousands											
Labor Force[b/]	39.8	40.4	39.6	39.9	40.0	40.1	41.2	41.9	40.4	40.2	41.8	42.3
Total Employment	37.7	37.0	35.6	36.6	36.6	37.1	37.7	38.6	36.1	37.4	38.6	38.2
Agriculture	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Construction[c/]	1.8	1.6	1.9	1.8	1.5	1.8	2.6	2.6	1.3	1.2	1.2	1.2
Manufacturing	14.2	13.0	11.7	12.2	12.0	12.0	11.1	10.7	9.3	10.2	10.5	9.7
Food	.9	1.0	.8	.9	.8	.8	.8	.8	.7	.9	.8	.8
Lumber	12.7	11.5	10.3	10.8	10.6	10.7	9.6	9.2	8.1	8.9	9.1	8.2
Other Manufacturing	.6	.6	.5	.5	.6	.6	.8	.7	.5	.5	.6	.6
Public Utilities	2.3	2.2	2.1	2.3	2.4	2.2	2.3	2.2	2.3	2.4	2.4	2.4
Trade	6.8	7.0	6.6	6.4	6.6	6.8	6.9	7.3	7.0	7.2	7.4	7.3
Finance, Insurance, & Real Estate[d/]	.8	1.0	.9	.9	.9	.9	1.0	1.0	1.0	1.0	1.0	1.0
Service	5.0	5.3	5.2	5.4	5.6	5.7	5.8	6.0	6.0	6.0	6.3	6.4
Government[e/]	4.5	4.6	4.9	5.3	5.4	5.4	5.9	6.4	6.9	7.0	7.6	7.8
Other[f/]	.4	.4	.4	.4	.4	.3	.3	.4	.3	.4	.4	.4
Unemployment[g/]	2.0	3.4	4.1	3.3	3.4	3.0	3.5	3.3	4.3	2.8	3.2	4.1
Unemployment Rate	5.0	8.4	10.4	8.3	8.5	7.5	8.5	7.9	10.6	7.0	7.7	9.7

a/ The Eureka Labor Market Area includes all of Humboldt County.

b/ Civilian labor force includes total employment and unemployment but excludes workers engaged in labor-management disputes. Industrial groupings are based on 1967 Standard Industrial Classification Manual.

c/ Includes operative builders and their employees.

d/ Excludes operative builders and their employees.

e/ Includes all civilian employees of federal, state, and local governments regardless of the activity in which the employee is engaged.

f/ Includes forestry, fisheries, miscellaneous agricultural services, and mining.

g/ Includes all persons without jobs and actively seeking work. Unemployment estimates are prepared in compliance with the U.S. Bureau of Employment Security's Handbook on Development of Basic Labor Market Information for Small Areas, May 1960.

Source: State of California, Department of Human Resources Development, Research and Statistics, 745 Franklin Street, Room 102, San Francisco, California 94102, mimeo, Revision of June 1970.

TABLE 6

Estimated Employment, Unemployment, and Labor Force

Eureka Labor Market,[a] 1969

	January	February	March	April	May	June	July	August	September	October	November	December	Average[h]
	thousands												
Labor force[b]	40.7	41.4	41.3	42.2	42.4	43.0	42.9	41.9	41.5	41.3	41.5	41.1	41.8
Total employment	36.7	36.4	37.5	39.4	40.3	40.8	40.2	39.2	39.0	38.7	38.0	36.9	38.6
Agriculture	1.9	1.9	1.8	1.8	1.9	1.9	2.1	2.0	2.1	2.0	1.9	1.8	1.9
Construction[c]	.9	.8	.9	1.1	1.2	1.3	1.5	1.4	1.4	1.4	1.3	1.0	1.2
Manufacturing	10.0	9.7	10.3	11.6	11.9	12.0	11.0	10.3	10.3	9.8	9.6	9.2	10.5
Food	1.0	.7	.8	1.0	1.0	.9	.9	.7	.7	.6	.7	.6	.8
Lumber	8.5	8.5	9.0	10.1	10.3	10.5	9.5	9.0	9.0	8.6	8.3	8.0	9.1
Other manufacturing	.5	.5	.5	.5	.6	.6	.6	.6	.6	.6	.6	.6	.6
Public utilities	2.2	2.3	2.4	2.5	2.6	2.5	2.6	2.5	2.5	2.5	2.5	2.1	2.4
Trade	7.0	6.9	7.1	7.3	7.5	7.5	7.5	7.6	7.5	7.6	7.4	7.6	7.4
Finance, insurance, and real estate	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Service	6.0	6.0	6.1	6.2	6.2	6.3	6.6	6.6	6.5	6.3	6.2	6.1	6.3
Government[e]	7.3	7.5	7.5	7.5	7.6	7.9	7.5	7.4	7.3	7.7	7.7	7.7	7.6
Other[f]	.4	.3	.4	.4	.4	.4	.4	.4	.4	.4	.4	.4	.4
Unemployment[g]	4.0	5.0	3.8	2.8	2.1	2.2	2.7	2.7	2.5	2.6	3.5	4.2	3.2
Unemployment rate	9.8	12.1	9.2	6.6	5.0	5.1	6.3	6.4	6.0	6.3	8.4	10.2	7.7

For footnotes see Table 5.

Source: See Table 5.

Table 6 provides information on the seasonality of the labor market in Humboldt County for 1969. The unemployment rate jumps sharply during the winter months November through March as a function of reductions in activity in lumber and construction during the season. This same pattern has been repeated, often more dramatically, each year throughout the decade. In several years, the unemployment rate has reached 15-20 percent during the winter months. Because of its high unemployment level, Humboldt County has been declared an economically depressed area by the Office of Economic Opportunity.

Given this picture of high chronic and seasonal employment it is not surprising that the establishment of a Redwood National Park in the late 1960's, with the prospects of a further reduction in lumbering, met with considerable local opposition. The opposition was not only from lumber interests, but from many citizens and groups of Humboldt County who directly or indirectly depended heavily on lumbering for their economic welfare. Several analyses attempted to assess the economic impact on the north coast of the establishment of the park [Decker, 1964, Little, A.D., Inc., 1967]. Expert opinion varied on the extent to which increased tourism would offset the reduction in jobs and income due to loss in lumber activity as a result of the park.

The Redwood Park issue was a case in which environmental quality and economic growth appeared at least potentially to be in conflict. To a greater extent, however, it was a question that the benefits of the park would be largely nationwide while the negative short-term economic consequences were likely to be borne locally. The future questions of whether the rivers of Humboldt County should remain as free flowing wild rivers raises a similar issue, with the cost of maintaining this national natural resource perhaps borne disproportionately by a local economy disrupted by periodic floods.

A second kind of environmental issue has appeared more recently in Humboldt County and is distinguished from the park and wild river issues by the fact that both the benefits and costs of improved environmental quality are felt primarily at the local level. These new issues include such problems as local air and water pollution, establishment of second-home subdivisions, and general population growth and overcrowding. Until recently these issues were not raised by any substantial or vocal portion of the community. When faced with what was apparently a long-term decline in lumbering, the

response of most private and public officials was that "new industry" must be found to maintain the economic growth of Humboldt County. Several organized attempts were made to attract new industry, using much the same techniques as used by state or local economic development agencies throughout the United States. Apparently, these efforts have thus far met with little success.

In the past two or three years, however, the questions are increasingly being asked: Is economic growth in Humboldt County really desirable? Would rapid economic growth and increased regional income substantially improve the economic conditions of the current population, or would it simply increase population growth through inmigration, leaving the current residents with approximately the same income level while decreasing the attractiveness of Humboldt County as a place to live? Concern for these types of questions, for example, appears to be implicit in the following statement by Mr. Don Peterson, Chairman of the Humboldt County Board of Supervisors, in a speech to the Fortuna Chamber of Commerce on January 11, 1971 [Eel Valley Advance, January 19, 1971]: "Our most important and over-riding economic concern is the reduction of the unemployment rate . . . . You notice that I said reduce the unemployment rate -- not increase the population."

OBJECTIVES

It is the overall objective of this report to provide a viable analytical framework for relevant private and public decision-making concerning issues of economic development and environmental quality in Humboldt County. The specific objectives contributing to this general objective are:

1. To construct an interindustry model of the Humboldt County economy, emphasizing the importance of natural resource-based sectors -- i.e., those sectors most likely to be directly affected by environmental decisions.

2. To make 1980 projections of the county economy under alternative specifications of the level of output, or final demand for, natural resource-based industries likely to be affected by environmental decisions -- e.g., the level of cut in the lumber industry, the size of catch of the fisheries industry, the level of recreation-tourism activity and the level of certain kinds of government activity directly related to environment.

3. To evaluate the employment, per capita income and income distribution consequences of these alternative projections, taking into account likely increases in productivity of labor (output per man hour).

KEY SECTORS OF THE HUMBOLDT COUNTY ECONOMY

Perhaps the most widely accepted model for explaining regional economic development is some version of the export-base model of regional growth [Richardson, 1969]. In this model, exports from the region are assigned the key role of generating flows of payments into the region, a certain portion of which are respent locally, creating a multiplier effect. In support of such a model Perloff and Wingo [1964] have shown that the economic development of major regions in the United States has been based, at least in the earlier stages, on exploiting a regional comparative advantage to create a strong export sector. With exports serving as the primary stimulus to growth, markets of sufficient size were eventually created within the region to attract new industries. Over time, the relative importance of exports declined as each region developed a more complex and self-sustaining economy.

Examining the Humboldt County economy in terms of an export-base theory seems particularly appropriate and instructive. As will be examined further in the input-output tables developed, the dominant export sector of Humboldt County is the forest products industry (primarily sales from sawmills, veneer and plywood plants, and pulp mills) with exports of approximately $200 million, followed by seafood processing with exports of about $13 million, and agriculture (primarily dairy products) with exports of about $10 million. All other kinds of manufacturing combined accounts for only about $16 million of exports; $5 million of transportation services (primarily water transportation through Humboldt Bay) are exported, and about $6 million in the service sectors (primarily hotels and motels associated with travel and tourism) are exported. Aside from these sectors the other exogenous source of growth for the county is about $77 million in spending by nonlocal government within Humboldt County. The bulk of this spending ($40 million) is for wages and salaries associated with education (elementary schools through the community College of the Redwoods, and Humboldt State College), and such government agencies as the Division of Highways, the Highway Patrol,

State Department of Parks and Recreation, Human Resources Development, California Division of Forestry, and Department of Fish and Game.

The striking fact which emerges from this examination of the exports of Humboldt County is the degree to which they are almost completely dominated by natural resource-based activities -- lumber, fisheries, agriculture, and tourism. As is clear from an examination of the important government agencies located in the county, even a large portion of state and federal expenditures locally are closely related to natural resources. Because of the heavy dependence of the county on these sectors, they are examined in more detail in the following sections.

The Forest Products Industry

Humboldt County is the most important lumbering county in California, accounting for slightly over 25 percent of the state's output of forest products. As shown earlier in Table 1, approximately 80 percent of the county's land area is devoted to timber as a primary use. Ownership of much of the most productive acreage is concentrated in five large integrated firms. Table 7 shows that the ownership of the commercial forests in Humboldt County is somewhat more concentrated in private hands than is the case statewide. (However, the new Redwood National Park, absorbing 71,600 acres of once industrially owned redwood forest land, alters these 1968 figures slightly.)

The forest products industry in Humboldt County can be conveniently divided into six major subdivisions: 1) Forestry, 2) Logging, 3) Sawmills, 4) Veneer and Plywood, 5) Pulp, and 6) Other Wood Products.

The Forestry sector includes tree farms and tree associated services. In Humboldt County this sector includes six firms employing about 50 people at an annual cost of around $193,000 [California Department of Human Resources Development, 1969]. This sector's output is the "stumpage value" of the harvested trees, measured as the value of the logs delivered to sawmills minus logging costs and transportation.

Commercial forest lands include both softwood and hardwood trees, but only softwoods contribute to commercial production. Within the softwood group, Douglas fir represents 50 percent of the logs consumed and 88 percent

TABLE 7

Percentage Distribution of Ownership of Sawtimber,
Humboldt County and California, 1968

	Humboldt County (percent)	California (percent)
Private (total)	66	57.2
Industry	44	--
Farm & Small Holdings	22	--
Public (total)	34	42.8
National Forest	26	--
Other	8	--
TOTAL	100	100

Sources: Oswald [1968] and Western Wood Products Association [1959-1969].

of the nonredwood softwood [Oswald, 1968]. Douglas fir, unlike redwood, appears evenly throughout the county and is not dominated by any one type of ownership. Redwoods, the second important softwood of Humboldt County, comprise 43 percent of the log consumption, yet make up only 18 percent of the commercial forests [Oswald, 1968]. A few lumber companies own all of the commercial redwoods except those found in the new Redwood National Park and the state parks.

Hardwoods, predominately Tanoak, make up 42 percent of the commercial forest area. The intrusion of hardwoods into once softwood stands results from improperly managed harvests, particularly on small holdings or farmer-owned lands. Though the rate of softwood regeneration has increased, the intrusion of hardwood varieties remains rapid. Except for firewood and posts, the quality of hardwood makes commerical utilization impractical, and major development of the hardwood resources does not seem likely. Thus the major component of the forestry sector -- softwood trees -- faces slow natural depletion. For example, the harvest rate of softwood varieties in recent years appears to have exceeded 200 percent net annual growth [Oswald, 1968]. It therefore appears that forestry output must decrease in the next decade if adequate stands are to remain to support the industry at a reasonable level. A more detailed discussion of forestry projections is included later.

The log output of the forestry sector is sold primarily to sawmills and to veneer and plywood plants. A majority of these sales are transactions within integrated firms. Exports of logs account for less than five percent of the Humboldt County cut [Austin, 1966].

The logging sector of the forest products industry consists of 126 firms providing incomes of about $9,059,000 annually for some 960 persons [California Department of Human Resources Development, 1969]. Logging is defined as the service of felling the trees and dragging them to a central loading area. The entire forest products industry shows seasonal influences, but logging activity has the greatest seasonality. The logging season begins in April and continues through September and into October, weather permitting. During this time sufficient log inventories must be accumulated to provide the sawmills, veneer, and plywood plants with a winter log supply adequate to maintain production.

Logging firms either operate on a contract basis, or exist as a part of a larger integrated firm. Independent logging firms generally consist of two to five men which contract out their services to lumber companies, generally for cutting second-growth or stumpage purchased from the U.S. Forest Service. In virgin stands, almost exclusively redwood, company crews fell the trees to insure minimum loss of the higher quality wood.

The Sawmill sector has the largest gross output of the forest products industry with a 1969 annual output of $124,189,000. Forty-six firms make up the sector, hiring 5,346 workers at a cost of $43.5 million [California Department of Human Resources Development, 1969]. The structure of the sector has changed significantly over time. Since 1960 the number of firms has decreased by over 140, the decline concentrated primarily in the one or two-man "Gyppo" operations. In general, only the large integrated lumber companies and the larger locally-owned mills have survived the technological changes and increased capital requirements in the industry. Today, the remaining mills face the transition from usage of large, virgin-stand timber to smaller, lower-quality second-growth.

The output of the sawmill sector consists of softwood lumber in its various stages: rough, green, dried or planed, and wood chips. Some firms specialize in various stages of production, but the larger firms integrate all components into one plant complex. Wood chips, a by-product of sawmills, are the primary input for the Pulp sector. The major markets for the output of the Sawmill sector are concentrated in the population centers of the San Francisco Bay Area and Los Angeles. Substantial quantities also make their way to eastern United States markets, Northern Europe and Japan. Table 8 gives a further breakdown of the channels of distribution and markets for California wood products, as well as mode of transportation used. Rail exceeds truck transportation for shipments from Humboldt County to other areas because of low grade roads. Rail also provides added flexibility in pricing either by volume or weight, depending upon the shipper's preference. Trucking firms are the exclusive carrier of wood chips, a wood by-product from milling which was formerly burned but now is used in pulp mills.

Veneer and Plywood plants form the fourth subdivision of the forest products industry. Eleven such firms operate in the county with a combined work force of approximately 1,800 people and a wage bill of $13.7 million

TABLE 8

Channels of Distribution, Principal Markets and Mode of Transportation of the Output of California Sawmills

Distribution of Output by Sawmills and Plywood & Veneer Plants	(percent)
Direct to user	8.6
Direct to retailer	9.2
Direct to wholesaler	60.3
Company owned distribution	3.4
Remanufacturing	18.5
TOTAL	100.0
Principal Markets	
California	60.6
Other Western states	4.9
Midwestern states	16.2
Northeastern states	5.5
South Central states	4.7
South Eastern states	4.8
Export	3.3
TOTAL	100.0
Mode of Transportation	
Rail	42.7
Truck	54.7
Water	2.6
TOTAL	100.0

Source: Western Wood Products Association, 1959-69.

[California Department of Human Resources Development, 1969]. Plywood production dominates the sector with five major plants. The sector appears rather unstable in that one facility closed in early 1969 and another recently halted production.

The veneer and plywood process absorbs about 20 percent of the sawlogs available in the county [Austin, 1969]. The cores that remain after removal of outer layers of wood, called peeler cores, are further processed by firms in the Other Wood Products sector.

Pulp ranks as the newest and fastest-growing subdivision in the forest products industry in Humboldt County. Both mills produce sulphate-bleached pulp, which is used in kraft type paper [Zivnuska, et al., 1965]. Production in 1969 was 392,574 tons, valued at approximately $59.4 million.

The most important input for pulp production is wood chips from local sawmills (plus small amounts from plywood and veneer plants) transported by truck and accumulated in huge piles around the mills. Both pulp mills maintain private docking facilities for ships that bring in chemicals and haul out wood pulp. The production process requires large quantities of electric power and water. The local water district allocates 60 million gallons per day to this industry, the largest single water consumer in Humboldt County [Humboldt County, 1969b].

All of the pulp produced leaves the county by ship from the company docks, primarily to Japan or to United States paper mills. Oswald [1968] indicates that pulp and paper production firms will eventually locate in Humboldt County, but other evidence suggests that, due to paper's shipping characteristics, paper mills usually locate near the final markets in population centers.

The by-products of the pulp production process have created some problems and controversy. Both companies have constructed pipelines into the ocean to facilitate disposal of liquid wastes. The unpleasant odors of the mills are carried by the prevailing winds to Eureka and areas immediately south. However, a study done at Humboldt State [McKenzie and Connett, 1969] indicates that property values have not significantly changed in the areas affected by air pollution.

The 25 miscellaneous firms dealing with the remaining products in the industry have been aggregated into one sector called Other Wood Products.

Five hundred persons are employed earning $1.7 million [California Department of Human Resources Development, 1969]. The main product in this sector is flakeboard, but shakes, lath, posts, and remanufactured wood products are also produced. The raw material for this sector comes from sawmills, veneer, and plywood plants. Scrap lumber, sawdust, some logs, and peeler cores represent the types of inputs needed.

Flakeboard (made from sawdust) dominates the total value of this sector. Along with the majority of forest products in Humboldt County, it is exported heavily to the San Francisco Bay Area and Southern California. Furniture manufacturing exists only on a limited scale in Humboldt County because of the high cost of transporting the finished product. Remanufacturing of lumber tends to concentrate around consumption points for this reason. The output of the Other Wood Products sector is minor in terms of dollar value, but its presence indicates more complete utilization of the by-products that were once burned by the other sectors.

The Agricultural Industry

The nature of agriculture in Humboldt County relates directly to the geographic characteristics of the county, particularly topography and climate. Flat land is scarce in Humboldt County (see earlier Table 2). The flat areas exist as river flood plains or coastal and river terraces. The only major concentration of flat land appears as the alluvial plains of the Mad, Elk, Eel, and Van Duzen Rivers around Humboldt Bay. Inland river courses appear as steep, narrow, river valleys and do not provide sufficient area to support agriculture. The Coast Ranges and Klamath Mountains transverse the county, confining agricultural activity to the coastal areas.

Humboldt County's climate reflects strong marine influence. The climate classification "Mediterranean cool summer with fog" stretches 10-20 miles inland, where there is a transition to "Mediterranean cool summer," and then to "Mediterranean warm summer" in the eastern mountain valleys [Durrenberger, 1968]. Annual precipitation ranges from 40 inches in the coastal lowlands to 80 inches in the high ranges. The wet coastal fogs of the coastal areas prevent pronounced drying during the summer months. Overall, the climate in Humboldt County is cool and fairly wet, with the warmest temperatures occurring in August and September. The 32^{o} growing season

in the coastal region varies from 325-350 days [University of California Agricultural Extension Service, 1967c].

Humboldt County agriculture can be divided into six sectors: Field Crops, Dairies, Other Agricultural Production, Dairy Processing, Meat Processing, and Other Food Production. The output and distinguishing characteristics of each sector is discussed below.

Field crops (defined as field crops plus vegetable crops in this case) represent only about four percent of total county agricultural output. In 1967 only 11 farms derived their major source of income from Field Crops, but many farmers have small acreages of field crops [Humboldt County Agricultural Commissioner's Report, 1968]. The two major crops are chipping potatoes and hay. Other vegetable crops such as tomatoes, sweet corn, squash, and artichokes play a supporting role. Chipping potato production has expanded rapidly in recent years and may replace marginal pasture land used by dairies [Lawrence and Leng, 1970]. Hay production continues at a level of about 2,000 acres with slowly increasing yields. Hay is being imported and is a major input into the Dairy sector. Trucks that carry lumber out of the county regularly haul in hay on their return trip [Lawrence and Leng, 1970]. Sweet corn and tomato production have fluctuated around the same level since 1969, while the aggregate of miscellaneous vegetable crops has been declining [Humboldt County Agricultural Commissioner's Report, 1960-71]. Artichokes are a new crop in Humboldt County, and have shown considerable potential. The harvest peak occurs just after the artichoke harvest in Monterey County has been completed, leaving a favorable market position for the Humboldt crop.

Dairy production and processing dominates Humboldt County's agriculture. The value of the raw product constitutes 24 percent of total agricultural output. There are 257 dairy farms in the county, located on the river bottomlands: 70 percent on the Eel, 25 percent on the Mad, and 5 percent on the remaining river lands. Two hundred-one farmers produce Grade B milk, mainly with small herds on rented land. Many of these Grade B operations are not economic units [Lawrence and Leng, 1970]. The remaining 56 dairies produce Grade A milk; approximately half of these operations are owner-operated and have larger herds of up to 250 head [University of California Agricultural Extension Service, 1966a and 1966b]. The milk produced is processed

locally. A decline in quantity of Grade B milk produced seems likely in Humboldt County though total value of milk will increase steadily due to increasing Grade A production.

Since inclement winter weather prohibits year-around grazing of herds, they must be wintered on hay. Another important factor in dairy production is the risk of loss from floods. The 1964 flood inflicted heavy damage upon dairy farmers, killing stock, destroying pasture, and washing away buildings.

"Other Agricultural Production" combines the remaining agricultural production into one large sector, including livestock production, eggs, tree crops, nursery products, honey, and furs. This sector represents about 12 percent of total agricultural output. Livestock production constitutes the largest subdivision of this sector, and includes beef, sheep, a small number of hogs, and rabbits. In 1967, 197 farms indicated livestock as their major source of income [University of California Agricultural Extension Service, 1967c]. Beef production, representing half of the sector's output value is located in the southeastern corner and along the coast. In an attempt to reduce hay and labor costs, a developing trend is to import calves in the spring, carry them on pasture and sell them in late fall [Lawrence and Leng, 1970]. The January 1 inventory of beef cows and calves has declined in recent years from 55,000 to 35,000. Sheep production continues to decline in Humboldt County. Where there were once great flocks grazing in the eastern portion of the county, today 90 percent of the sheep are found in the southwestern corner. The migration is attributed to low wool prices and high losses due to coyotes. Poultry and egg production are also declining. Egg production is carried on by only two full-time producers and a number of side-line operations. Flowers and horticultural plant production is expanding in Humboldt County and, though relatively small in acreage, ranks second in importance in this sector. The major products are daffodils, bulbs, ornamental plants, and trees produced on the flat terrace land. Tree crops and furs (mink) are decreasing in Humboldt County, with furs being gradually phased out. Honey production remains unimportant and shows no signs of important growth.

The Meat Processing sector is small, with less than one percent of all local meat animals slaughtered in Humboldt County [Humboldt County Agricultural Commissioner's Report, 1969]. Only four abatoirs operate in the county and they handle mainly culls and ranch butchering. The meat processing

industry consists mainly of boning, cutting, and processing imported carcasses for institutional use, such as for hospitals, schools, and restaurants.

The Dairy Processing sector is based on the large quantities of locally produced milk and contributes about 42 percent of total agricultural output in the county. There are two plants located at Fernbridge and Loleta that provide the residents with fluid milk and dairy products, while exporting large quantities of dry powdered milk. The two plants have capacities for manufacturing milk (Grade B) far beyond the present milk supply. Since the Grade A production is about twice the quantity that can be marketed in the county, the excess is channeled into manufacturing. Local supermarkets control an estimated 20-25 percent of fluid milk sales, but their milk is shipped into the county because of an uncertain local supply during the winter months [University of California Agricultural Extension Service, 1967c].

The remaining 17 percent of total agricultural output is produced in the Other Food Processing sector, which consists of seven firms dealing in various food preparations. The major components of the sector are prepared animal feeds, bakery products, soft drinks, animal and marine fats and oils, and manufactured ice. A majority of this sector's inputs must be imported because the raw products are not locally available, with the exception of animal and marine fats and ice. The nature of this sector presently is to supply local demand. Although there have been expressions of interest in a vegetable processing plant in the county [Humboldt County, 1971], the general decline in vegetable acreage appears discouraging. A further possibility may be to establish a chipping plant for locally produced potatoes.

The Fishery Industry

Humboldt County, due to its coastal location and proximity to the productive Japanese to California current, is a major source of fresh and frozen fish products for California and western United States markets. The fishery resource supplies the raw material for two industries, commercial fishing and seafood processing. In addition, two oyster processing firms cultivate oysters within Humboldt Bay. Together, these industries generate an output of approximately 21 million dollars (1969) and employ 1,800-2,100 workers [California Human Resources Development, 1969]. Based on interviews

with industry sources, it is estimated that approximately five percent of the fish processed in Humboldt County are consumed locally, with the remainder shipped to Los Angeles, San Francisco, and other domestic markets.

There are approximately 200-300 commercial vessels operating out of Humboldt County [Smith, 1970], and approximately 1,800 licensed commercial fishermen. These figures fluctuate seasonally, as many vessels move up and down the Pacific Coast and may only be in Humboldt County ports for a few months each year. The commercial fishing industry of Humboldt County is characterized by an aging, outdated fleet and a declining work force of competent fishermen. The vessels are small by commercial standards (generally less than 30 feet) and do not usually possess full electronic gear. Most vessels are equipped to fish for at least three species, usually salmon, albacore and crab, with the rest concentrating on groundfish. According to commercial fishermen, it is necessary for the multipurpose vessels to fish for all three species in order to realize any return on investment and management [Oregon State University, undated]. The principal costs of operation for these vessels are fuel and ice, for most vessels lack refrigeration. The fishermen are generally paid in shares of the catch, with the captain receiving a double share.

The fish are brought into port and are sold at the docks to the processors at prices which are usually negotiated before the fishing season begins. However, the abundance or scarcity of fish may affect the rigidity of prices. Weight of catch and prices for each species are recorded by the California Department of Fish and Game, and filed in Long Beach, California. The docks at Eureka are owned by the city and are currently occupied under lease arrangements by two processors. These docks have been declared unsafe and in need of complete rebuilding. Should these docks and facilities be closed, the fishermen who already face a shortage of dock space would be placed in a difficult economic position. Such a closure would leave at least 300 workers unemployed. There is discussion of construction of more modern processing facilities, such as the one new plant in Eureka which was built in 1967. Additionally, the mooring facilities are inadequate for the number of vessels using the ports and given the increased number of sports-fishing and private pleasure boats. This lack of moorage space could constrain the growth of recreational boat usage in Humboldt County.

The seafood processing industry, with the exception of one firm, is also in need of renovation. At times seafood processing firms cannot handle the full catch of the fishing fleet, resulting in some loss of the catch -- this loss being borne by the fishermen. In addition, many species of groundfish are not currently being utilized because processors are not equipped to handle them due to lack of technological innovation. These species, which die as a result of being netted, represent a loss of high protein food as well as an economic loss to the fisherman. The use of more of these species could help offset the diminished production of some presently valuable commercial species.

The fishing industry, in addition to providing seafood products, also is a major attraction for tourists. How much the presence of the fishing industry adds to tourism is not known, but it must be considered in planning for the growth of the tourist industry. Salmon are a highly sought after game fish, being pursued by ocean sports and stream fishermen.

The principal species caught off Humboldt County (salmon, albacore, groundfish and dungeness crabs) are under increasing commercial pressure due to rising demand and prices. In addition, man's activities have caused declines in the population of some of these species, particularly the salmon and dungeness crabs. The harvest of these commercial species is regulated by the California Department of Fish and Game which attempts to balance harvest with the reproductive capacity of the species. The commercial fishermen are not always in agreement with Fish and Game management proposals (delayed salmon season opening, etc.) and have been fairly successful in stopping regulation changes which were felt to impose economic hardships on the commercial fishermen, particularly in the area of salmon harvest. It does not appear that the fisheries sector will increase in importance, given the fixed or dwindling supply of fish of commercial value, unless the growth of aquaculture (raising of fish in commercial volume under controlled conditions) spurs an increase in the production of fish products. To date only limited interest has been expressed concerning the use of Humboldt Bay waters for such operations.

The Recreation and Tourism Industry

Recreation and tourism in Humboldt County are based on camping and sightseeing, fishing, hunting, and motel or lodging activities with their related amenities. A National Park Service study [Humboldt County, California, 1969b] estimated 2 million visitor-days of tourism in Humboldt County in 1964. In all likelihood, the current figure is somewhat higher. Based on data sources and methods outlined later, the authors estimate that the 2 million visitor-days can be disaggregated as follows: campers (740,000), motel visitors (630,000), one day users (630,000). The expenditures of these visitors in other sectors were estimated as follows:

Retail and wholesale trade	$5.0 mil.
Hotels and motels	4.1
Selected services	0.6
Entertainment	1.2
Total	$10.9 mil.

Camping and sightseeing possibilities can be summarized as follows:

1) Redwood Ecotype
   a. Redwood National Park: The Park consists of approximately 64,000 acres in northern Humboldt County and contains numerous groves of virgin redwoods.
   b. State Redwood Parks and Groves: The State of California owns over 56,000 acres, contained in five parks, where redwood flora and fauna may be viewed by campers and sightseers.
2) Whitewood Forest Ecotypes
   a. Six Rivers National Forest: Approximately 305,000 acres of this national forest are contained within Humboldt County, with six campgrounds open to the public.
   b. State Campgrounds and Reserves: There are three state-owned areas where camping and sightseeing within this type of forest environment are allowed.
3) Marine Ecotype
   a. State Campgrounds: There are four state owned camping areas on or within close proximity to ocean and beach areas.
   b. County Parks: The county maintains 11 parks or recreation facilities with ocean or estuary access.

Sport fishing possibilities are as follows:

1) Ocean Fishing: Salmon and rockfish are prevalent off the Humboldt coast. Launching facilities are available, as are rental boats. In addition, the beach and estuary areas provide areas for clamming and crabbing.
2) Freshwater Fishing: The numerous streams within Humboldt County provide summer fishing for trout and young steelhead and winter fishing for salmon and steelhead.

Hunting possibilities include:

1) Deer and other big game: This activity is confined mainly to the eastern portion of the county, where federal lands are open to hunting.
2) Waterfowl: This activity is principally on Humboldt Bay, which is the largest wintering area in California for Black Sea Brandt.

Motels and hotels are located primarily in Eureka and Arcata, which are convenient sites for overnight lodging for persons traveling the coast from the San Francisco Bay Area to Oregon and Washington. The moderate inland summer climate and forested environment is suited to longer visitations by tourists who prefer more luxurious accomodations than are to be found in campgrounds. Such resorts usually provide recreation activities such as golf and swimming.

AN INTERINDUSTRY MODEL OF THE HUMBOLDT COUNTY ECONOMY

An input-output model is a well known tool used to describe and analyze interrelationships between sectors of an economy (see Miernyk, 1966 and Martin and Carter, 1962). The economy may be national in scope as were the original applications of I-O or regionally or community based as in this study of Humboldt County (see for example Harmston and Lund, 1967). Regardless of the boundaries of the economic activity studied, three separate stages of analysis are involved.

In the first stage, a transaction table is constructed. First sectors relevant to the analysis must be defined. Then the output of each sector of the region is allocated to purchasing or using sector. For this stage of analysis, output may be in physical units but to aggregate all economic activity into a workable number of sectors, flows or transactions are generally converted to money units, usually the value to the producer. Thus, a "double entry accounting" of the dollar flows of all goods and services

from one sector to another results. Potentially, the number of entries in the transaction table is the square of the number of sectors defined. Of course in practice many of the sales are zero, leaving empty "boxes" in the transaction table. If all sectors are endogenous, the system is referred to as a "closed" model. When the model is not completely self-contained (i.e., sectors such as households, exports, and government purchases are autonomous) the system is termed "open." The model used for this study is partially open; that is, the household sector is included as one of the endogenous sectors but exports and state and federal government are "outside."

After constructing the transaction table which is the major effort in I-O model building, a table of input-output coefficients is easily obtained. By input-output coefficient we mean the amount of inputs (in dollars) required from each sector to produce one dollar's worth of the output of a given sector. A basic and simple assumption is made that the technical coefficient is measured from a single observation of the ratio between the transaction of one sector to another and the gross output of the receiving sector.

The third table developed for an input-output study is the interdependence coefficient table. Each interdependence coefficient summarizes not only the direct dependence of one sector on another, but also the indirect and circular dependence of one sector on another. The interdependence coefficient table may be summarized in different ways to yield useful insights into the relative interaction affects of different sectors. For example, by summing down the columns of the interdependency table, we derive what is commonly referred to as output multipliers. This is the total dollar value of inputs generated from all sectors (directly and indirectly) associated with a one dollar sale to final using sectors. Other types of multipliers are derived which are referred to as income and employment multipliers. These will be defined in a later empirical section.

Definition of Sector

Definition of sectors is somewhat arbitrary, but careful examination of key sectors discussed previously provides useful guidelines for further disaggregation of the Humboldt economy. Agriculture was disaggregated into six sectors: 1. Field Crops; 2. Dairy Farms; 3. Other Agricultural Production;

4. Meat Processing; 5. Dairy Processing; and 6. Other Food Processing. Fisheries and Mining made up a second group of three sectors: 7. Seafood Processing; 8. Mining; and 9. Fisheries. Forest Products was disaggregated into five sectors: 10. Forestry; 11. Logging Camps and Contractors; 12. Sawmills; 13. Veneer and Plywood; 14. Pulp Mills; and 15. Other Wood Products. Other Industry was defined as three sectors: 16. Construction; 17. Boat Building and Repair; and 18. Other Local Manufacturing. Transportation activities are aggregated into two sectors: 19. Water Transportation; and 20. Other Transportation. Trade is defined by four sectors: 21. Communication and Utilities; 22. Wholesale and Retail Trade; 23. Finance and Insurance; and 24. Real Estate. Services are disaggregated into four sectors: 25. Hotels and Motels; 26. Selected Services; 27. Entertainment; and 28. Medical, Legal and Professional Services. Government activity is divided between 29. Local Government; and 32. Nonlocal Government. 30. Local Households is defined as a single sector. Row sector 31 is imports to Humboldt county, whereas column sector 31 is exports from the county. Following is a brief description of each of the sectors with their alignment with the Standard Industrial Code (SIC).

Sector No.	SIC	Description
1. Field Crops	0113 0119 0123	Production of cash grains, hay, vegetables.
2. Dairy Farms	0132	Production of cows' milk and other dairy products.
3. Other Agricultural Production	01-07 not included in sectors 1 & 2	Production of fruit and nut crops, nursery stock, eggs, livestock and poultry, wool, and miscellaneous products (also includes ASC lamb, wool, and mohair payments).
4. Meat Processing	2011	Slaughtering of cattle, hogs, sheep, lambs, and calves for canning and curing either on the premises or by the purchaser.
5. Dairy Processing	202	Processing of milk into market fluid milk or milk products such as butter, cheese, and ice cream.
6. Other Food Processing	203-209 excluding seafood or fish processing	Manufacturing of animal and poultry feed, bakery products, beverages, and miscellaneous food products.

Sector No.	SIC	Description
7. Seafood Processing	2031 2036	Processing of fish and other seafood products for sale fresh, canned, or frozen.
8. Mining	1311 1442 1499	Extraction and processing of natural gas, sand and gravel, and stone.
9. Fisheries	0912 0913	Catching of finfish and shellfish.
10. Forestry	08	Operation of timber tracts, forest nurseries, and related activities.
11. Logging Camps and Contractors	2411	Cutting timber and dragging it to the loading docks; does not include transport to mills.
12. Sawmills	2421 2429	Manufacturing lumber from timber.
13. Veneer and Plywood	2432	Production of veneer and plywood.
14. Pulp Mills	2611	Manufacturing pulp from wood or other materials.
15. Other Wood Products	2433 244	Production of shake, lath, flakeboard and other miscellaneous wood products.
16. Construction	1511 1611 1621 1711 1731 6560	Private and government construction of all kinds.
17. Boat Building and Repair	3732	Construction, repair, and conversion of all types of boats.
18. Other Local Manufacturing	27, 28, 29, 32, 34, 35, 37, 38 39	Manufacturing of a wide variety of products such as newspapers, chemicals, concrete, metal products, etc.
19. Water Transportation	4411 4421 4422 4454 4463 4469	Shipping to foreign and domestic destinations, towing and tugboat service, cargo handling, and miscellaneous services.

Sector No.		SIC	Description
20.	Other Transportation and Warehousing	4011 4212 4213 4214 4225 4226 4231	All trucking, warehousing, and railroad services.
21.	Communications and Utilities	4811 4911 4923 4941	Telephone, electricity, natural gas, and water supply.
22.	Wholesale and Retail Trade	50, 52-59	Wholesale and retail trade of all kinds.
23.	Finance and Insurance	6022 6025 6123 6131 6312 6313 6322 6323 6324 6332 6333 6351 6352 6411	Banking, savings and loan associations, and insurance services.
24.	Real Estate	65	Real estate brokerage, property leasing, and title companies.
25.	Hotels, Motels, and Camps	70	Commercial and institutional establishments that furnish lodging or camping space on a fee basis.
26.	Selected Services	721-729 732-739 751-754 762-769	Personal services (laundries, barbers, etc.), miscellaneous business services (advertising, leasing, etc.), auto repair, and others.
27.	Entertainment	7814 782 783 791 7929 793 7942 7943 7945 7947 7949	Theaters, musicians, dance schools, bowling alleys, golf courses, etc.

Sector No.	SIC	Description
28. Medical, Legal, and Professional Services	80 81 89	Medical and dental facilities, attorneys, accountants, engineering services, etc.
29. Local Government	93	Services rendered by county, city, special district, and school districts primarily measured by the amount of taxes paid by each sector of the economy.
30. Local Households		Output from this (row) sector consists of wages and salaries, proprietors' income, depreciation and interest. Inputs (column) are expenditures for goods and services by private individuals.
31. Imports (Exports)		Public and private expenditures on goods and services purchased from (sold to) sectors not included in Humboldt County.
32. Nonlocal Government	91 92	Services rendered by state and federal agencies primarily measured by the amount of nonlocal taxes paid by each sector of the economy.

Brief Summary of Construction Procedures

The transaction table for Humboldt County was constructed from data obtained from a combination of sources, including a survey of selected business firms, published secondary data on the county, and other input-output studies. The principal steps involved are summarized below. The detailed procedures are contained in Appendix A.

1. Total output (or sales) was estimated for each business sector 1 through 28, primarily from secondary data sources.
2. A personal survey of business firms was carried out, concentrated primarily in the key natural resource sectors of agriculture, forestry, fisheries and lumber (sectors 1-15). Cost information from the firms was used to construct input-output coefficients for most of these key sectors. Input-output coefficients for most of the remaining business sectors (16-28) were obtained from United

States and Washington State input-output tables. The input-output coefficients obtained at this stage represent total inputs regardless of whether or not they are purchased from within or outside of Humboldt County.

3. Local government output and distribution of expenditures were obtained from the published county and city budgets and other published data on local governments.
4. Household output was taken to equal published personal income in Humboldt County. The distribution of consumer expenditures was based on published consumption studies for small nonurban areas in the western United States.
5. On the basis of the above information, a county export-import balance was calculated for each sector 1-28. If the county was deficit in the sector (i.e., if local "requirements" exceeded local production) the required imports for each row were subtracted from sector flows in that row on a proportionate basis. Imports of all such items were then summed for each column sector to obtain imports in row 31. If the county was a surplus producer (i.e., local production exceeded local requirements) the surplus was entered as an export in the final demand portion of the table.

A check on the accuracy of the flow table is the comparison of row and column estimates of household income. The sum of payments to households in row 30, including payments from all business sectors 1-28, from local government and local households (sectors 29 and 30), and from nonlocal government, was within about five percent of the total personal income estimate of $388,798,000 for Humboldt county. Reconciliation and adjustment procedures described in Appendix A were developed to force a balance.

Transaction and Input-Output Coefficients Tables

The Transactions Table (Table 9) contains considerable useful information about the Humboldt County economy. An overall look at the table shows that the lower portion of the table is relatively dense. This is an indication that the transportation, trade, services, local government and households sell their services to practically every sector of the economy. The basic industries of the economy (agriculture, fishing and mining, and forest

TABLE 9

The 1969 Humboldt County Transactions Table ($1,000)

Sector Group, Description and Number			Agriculture						Fishing & Mining			Forest Products		
			Field Crops	Dairies	Other Ag. Prod.	Meat Proc.	Dairy Proc.	Other Food Proc.	Sea-Food Proc.	Mining	Fishing	Forestry	Logging	Sawmills
Sector Group	Sector Description	Sector No.	1	2	3	4	5	6	7	8	9	10	11	12
Agriculture	Field Crops	1	28	267	44			71						
	Dairies	2					7000							
	Other Ag. Products	3			99	19		27				516		
	Meat Processing	4						7						
	Dairy Processing	5						73						
	Other Food Processing	6						117						
Fishing & Mining	Seafood Processing	7												
	Mining	8												
	Fisheries	9							7316					
Forest Products	Forestry	10										770	33	31,357
	Logging	11										23		16,644
	Sawmills	12			39									186
	Veneer-Plywood	13												
	Pulp Mills	14												
	Other Wood Products	15						3						
Other Industry	Construction	16	14					15	139	5				
	Boat Building	17									481			
	Other Local Mfg.	18	57	98	78			42	99		44		550	397
Trans.	Water Trans.	19						12						
	Other Trans.	20		104		25		171		9	105	426	900	1528
Trade	Comm. & Util.	21	23	93	113	10	136	70	107	17	-	76	57	1386
	Wholesale & Retail	22	26	463	134	4		179	57	7	68	86	263	5659
	Finance, Insurance	23	9	95	235	2	107	23	68	29	397	34	198	1327
	Real Estate	24						46						
Services	Hotels & Motels	25												
	Selected Services	26	12	43	26	2	19	34	15	9	33	63	356	556
	Entertainment	27												
	Med., Legal, Other	28	3	143	79	1		29	34	135		23	116	522
Local Payments	Local Government	29	86	435	480	5	83	148	133	72	56	2039	58	1784
	Local Households	30	794	3500	2194	202	1508	1663	3053	1420	5288	5377	14,964	39,587
Payments to	Imports	31	178	2712	463	493	5398	2837	623	763	805	2115	2210	16,922
	Nonlocal	32	4	118	47	18	92	238	438	372	61	27,548	630	6334
Total Purchases			1234	8071	4031	781	14,343	5805	14,082	2838	7338	39,096	20,335	124,189

(Continued on next page)

TABLE 9 (Con't.)

The 1969 Humboldt County Transactions Table ($1,000)

Sector Group, Description and Number			Services				Local Payments		Final Demand		Total Sales
			Hotels & Motels	Selected Services	Enter-tainment	Medical, Legal, Other	Local Gov't.	Local House-holds	Exports	Fed. & State Gov't.	
Sector Group	Sector Description	Sector No.	25	26	27	28	29	30	31	32	
Agriculture	Field Crops	1						817			1234
	Dairies	2							1071		8071
	Other Ag. Products	3			7			3353			4031
	Meat Processing	4				2		768			781
	Dairy Processing	5				28		5715	8433		14,343
	Other Food Processing	6				14		5637			5805
Fishing & Mining	Seafood Processing	7						1361	12,721		14,082
	Mining	8							2664		7838
	Fisheries	9		3					14		7338
Forest Products	Forestry	10							47		39,096
	Logging	11							157		20,335
	Sawmills	12							108,260		124,189
	Veneer-Plywood	13							26,694		28,233
	Pulp Mills	14							59,361		59,361
	Other Wood Products	15						2916	5886		9540
Other Industry	Construction	16		5	25	106	2732	5745		7980	17,797
	Boat Building	17									487
	Other Local Mfg.	18		22	43	149		1322	16,478		19,929
Trans.	Water Transportation	19							3043		3518
	Other Transportation	20		12	10	28	347		1,825	626	17,306
Trade	Comm. & Util.	21	241	1229	99	471	738	13,303		291	25,559
	Wholesale & Retail	22	11	72	87	205	1044	47,635		2670	64,245
	Finance, Insurance	23	4	59	39	142	470	10,860		4588	22,232
	Real Estate	24		61	494	225	14		374	322	3576
Services	Hotels & Motels	25					344		4100		4444
	Selected Services	26	56	257	25	78	84	2496		7182	12,964
	Entertainment	27			106			3499	1235		4953
	Med., Legal, Other	28	11	172	236	748	1878	21,034	1008	106	28,459
Local Payments	Local Government	29	328	330	124	725		14,981		12,793	42,797
	Local Households	30	3463	5603	1163	21,636	29,503	46,731	22,631	40,182	388,798
Payments to	Imports	31	322	4904	704	3949	5643	(20,684) = 151,334	Savings		
	Nonlocal	32	8	235	1791			28,607			
Total Purchases			4444	12,964	4953	28,506	42,797	388,798			

(Continued on next page)

TABLE 9 (Con't.)

The 1969 Humboldt County Transactions Table ($1,000)

Sector Group, Description and Number			Forest Products			Other Industry			Transportation		Trade			
			Veneer & Plywood	Pulp Mills	Other Wood Prod.	Construc-tion	Boat Blding.	Other Local Mfg.	Water Trans.	Other Trans.	Commun. & Utilities	Whole-Sale & Retail	Finance & Insurance	Real Estate
Sector Group	Sector Description	Sector No.	13	14	15	16	17	18	19	20	21	22	23	24
Agriculture	Field Crops	1								7				
	Dairies	2												
	Other Ag. Products	3				8					2			
	Meat Processing	4						2				2		
	Dairy Processing	5						36				58		
	Other Food Processing	6								2		35		
Fishing & Mining	Seafood Processing	7												
	Mining	8			6	157				8				
	Fisheries	9										8		
Forest Products	Forestry	10	6564		275							50		
	Logging	11	3375		141									
	Sawmills	12		13,034	1155	539		967			3	6		
	Veneer-Plywood	13	594		409	333		213						
	Pulp Mills	14												
	Other Wood Products	15			242	192		195			67	39		
Other Industry	Construction	16			17			18	28	432	256	135	62	83
	Boat Building	17					1		3		2			
	Other Local Mfg.	18			192				4	22	26	154	134	18
Trans.	Water Transportation	19			30				409	11		13		
	Other Transportation	20		9122	323	343	2	12	37	908	92	308	25	18
Trade	Comm. & Util.	21	126	3047	145	131	3	235	33	166	1450	1030	701	32
	Wholesale & Retail	22	677	2454	297	1341	1	226	22	265	34	56	171	31
	Finance, Insurance	23	16	149	42	94	2	109	47	124	133	452	2345	33
	Real Estate	24			131				36	281	33	591	906	62
Services	Hotels & Motels	25												
	Selected Services	26	92	707	24	67	1	70	8	26	98	311	189	25
	Entertainment	27										26	87	
	Med., Legal, Other	28		142	36	22	1	191	20	97	256	630	746	40
Local Payments	Local Government	29	406	3629	242	404	12	506	90	440	650	1101	566	91
	Local Households	30	12,805	14,807	2965	4987	320	10,862	2448	11,194	12,020	50,264	10,920	2744
Payments to	Imports	31	2153	9243	2405	8252	140	6110	333	2823	3850	7371	3471	317
	Nonlocal	32	1440	3027	463	927	4	177		800	6887	1605	1903	72
Total Purchases			28,233	59,361	9540	17,797	487	19,929	3518	17,306	25,559	64,245	22,232	3576

products), on the other hand tend to show entries in the diagonal blocks, indicating a high concentration of transactions among sectors of a particular industry. For example, agricultural sectors trade heavily with other agricultural sectors, and the various forest product sectors trade heavily with others in that block.

The input-output coefficient table (Table 10) depicts the input structure of each sector in the economy. Consider the sawmill sector: in 1969, to produce $1.00 worth of output, sawmills purchased $0.25 worth of inputs from forestry (trees) and $0.13 of logging services; it paid local households $0.32 and nonlocal households $0.05 per $1.00 of output -- in the form of wages and salaries, rents, interest, depreciation and profits; it imported from outside the county $0.14 worth of inputs; in addition it purchased minor amounts of various services. The input structure of each sector can be examined similarly, giving the purchases from other local industries, payments in taxes to local government and payments to local households, as well as reliance on imports and the amount of payments to nonlocal households. The reader interested in particular sectors can examine the table directly for additional information.

The Interdependence Coefficient Table and Multiplier Analysis

Table 11 is the interdependence coefficient table for the Humboldt County economy. The coefficients in each column of Table 11 show the increase in output of each row sector required to deliver an additional $1 to final demand for that column sector. For example, if exports (a component of final demand) of Dairy Processing Products (sector 5) are increased by $1.00, column 5 shows the additional output required from each sector of the economy to support that additional demand: Field Crop output (sector 1) would increase by $0.0183, Dairy output (sector 2) by $0.4929, and so on. The total of column 5 ($2.6062) is therefore the total impact on the output of all sectors combined of a $1 increase in final demand (exports) of the Dairy Processing sector. This figure is called the "output multiplier," showing that the total expansion of Humboldt County production is $2.6062 for every $1 of increase in exports of Dairy Processing.

The lowest output multipliers tend to be for those industries with a high "leakage" from the local economy. For example, Meat Processing and

TABLE 10

The 1969 Humboldt County Input-Output Coefficient Table ($)

Sector Group, Description and Number			Agriculture						Fishing & Mining			Forest Products		
			Field Crops	Dairies	Other Ag. Prod.	Meat Proc.	Dairy Proc.	Other Food Proc.	Sea-Food Proc.	Mining	Fishing	Forestry	Logging	Sawmills
Sector Group	Sector Description	Sector No.	1	2	3	4	5	6	7	8	9	10	11	12
Agriculture	Field Crops	1	.0226	.0330	.0109			.0122						
	Dairies	2			.		.4880							
	Other Ag. Prod.	3			.0245	.0243		.0046				.0131		
	Meat Processing	4						.0012						
	Dairy Processing	5						.0125						
	Other Food Processing	6						.0201						
Fishing & Mining	Seafood Processing	7												
	Mining	8												
	Fisheries	9							.5195					
Forest Products	Forestry	10										.0196	.0016	.2524
	Logging	11										.0005		.1340
	Sawmills	12			.0096									.0014
	Veneer-Plywood	13												
	Pulp Mills	14												
	Other Wood Products	15						.0005						
Other Industry	Construction	16	.0113					.0025	.0098	.0017				
	Boat Building	17									.0655			
	Other Local Mfg.	18	.0461	.0121	.0193			.0072	.0070		.0059		.0270	.0031
Trans.	Water Transportation	19						.0020						
	Other Transportation	20		.0128		.0320		.0294		.0031	.0143	.0108	.0442	.0123
Trade	Comm. & Util.	21	.0186	.0115	.0280	.0128	.0094	.0120	.0040	.0059		.0019	.0028	.0106
	Wholesale & Retail	22	.0210	.0573	.0332	.0051		.0308	.0040	.0024	.0092	.0021	.0129	.0455
	Finance, Insurance	23	.0072	.0177	.0582	.0025	.0074	.0039	.0048	.0102	.0541	.0008	.0097	.0106
	Real Estate	24						.0079						
Services	Hotels & Motels	25												
	Selected Services	26	.0097	.0053	.0064	.0025	.0013	.0058	.0010	.0031	.0044	.0016	.0175	.0044
	Entertainment	27												
	Med., Legal, Other	28	.0024	.0177	.0195	.0012		.0049	.0024	.0475		.0005	.0057	.0042
Local Payments	Local Government	29	.0696	.0538	.1190	.0064	.0057	.0254	.0094	.0253	.0076	.0521	.0028	.0143
	Local Households	30	.6434	.4336	.5442	.2586	.1051	.2864	.3592	.5003	.7206	.1375	.7358	.3187
Payments to	Imports	31	.1442	.3310	.1148	.6312	.3763	.4887	.0442	.2688	.1097	.0540	.1086	.1362
	Nonlocal	32	.0032	.0146	.0116	.0230	.0064	.0409	.0311	.1310	.0083	.7046	.0309	.0510
Total Purchases		a/	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

a/ Sums of Column Coefficients do not always add precisely to 1.0000 because of rounding errors.

(Continued on next page)

TABLE 10 (Con't.)

The 1969 Humboldt County Input-Output Coefficient Table ($)

Sector Group, Description and Number			Forest Products			Other Industry			Transportation		Trade			
			Veneer & Plywood	Pulp Mills	Other Wood Prod.	Construc-tion	Boat Blding.	Other Local Mfg.	Water Trans.	Other Trans.	Commun. & Utilities	Whole-Sale & Retail	Finance & Insurance	Real Estate
Sector Group	Sector Description	Sector No.	13	14	15	16	17	18	19	20	21	22	23	24
Agriculture	Field Crops	1								.0004				
	Dairies	2												
	Other Ag. Products	3				.0004					.0001			
	Meat Processing	4						.0001				-		
	Dairy Processing	5						.0018				.0009		
	Other Food Processing	6								.0001		.0005		
Fishing & Mining	Seafood Processing	7												
	Mining	8			.0006	.0088								
	Fisheries	9										.0001		
Forest Products	Forestry	10	.2324		.0288							.0007		
	Logging	11	.1193		.0147									
	Sawmills	12		.2195	.1210	.0302		.0485			.0001	.0001		
	Veneer-Plywood	13	.0206		.0428	.0187		.0106						
	Pulp Mills	14												
	Other Wood Products	15			.0253	.0107		.0097			.0026	.0006		
Other Industry	Construction	16			.0017			.0009	.0079	.0249	.0100	.0021	.0027	.0232
	Boat Building	17					.0020		.0008		.0001			
	Other Local Mfg.	18			.0201				.0011	.0012	.0010	.0023	.0060	.0050
Trans.	Water Transportation	19			.0031				.1162	.0006		.0002		
	Other Transportation	20		.1536	.0338	.0192	.0041	.0006	.0105	.0524	.0035	.0047	.0011	.0050
Trade	Comm. & Util.	21	.0044	.0513	.0151	.0073	.0061	.0117	.0093	.0095	.0567	.0160	.0315	.0089
	Wholesale & Retail	22	.0239	.0413	.0311	.0753	.0020	.0113	.0062	.0153	.0013	.0008	.0076	.0086
	Finance, Insurance	23	.0005	.0025	.0044	.0052	.0041	.0054	.0133	.0071	.0052	.0070	.1054	.0092
	Real Estate	24			.0137				.0102	.0162	.0012	.0091	.0407	.0173
Services	Hotels & Motels	25												
	Selected Services	26	.0032	.0119	.0025	.0037	.0020	.0035	.0022	.0015	.0038	.0048	.0085	.0069
	Entertainment	27										.0004	.0039	
	Med., Legal, Other	28		.0023	.0037	.0012	.0020	.0095	.0056	.0056	.0100	.0098	.0335	.0111
Local Payments	Local Government	29	.0143	.0611	.0253	.0227	.0246	.0253	.0255	.0254	.0254	.0171	.0254	.0254
	Local Households	30	.4535	.2494	.3107	.2802	.6570	.5450	.6958	.6468	.4702	.7823	.4911	.7673
Payments to	Imports	31	.0762	.1557	.2520	.4636	.2874	.3065	.0946	.1631	.1388	.1147	.1561	.0886
	Nonlocal	32	.0510	.0509	.0485	.0520	.0082	.0088	-	.0288	.2694	.0249	.0855	.0201
Total Purchases		a/	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

(Continued on next page)

TABLE 10 (Con't.)

The 1969 Humboldt County Input-Output Coefficient Table ($)

Sector Group, Description and Number			Services				Local Payments	
			Hotels & Motels	Selected Services	Enter-tainment	Medical, Legal, Other	Local Gov't.	Local House-holds
Sector Group	Sector Description	Sector No.	25	26	27	28	29	30
Agriculture	Field Crops	1						.0021
	Dairies	2						
	Other Ag. Products	3			.0014			.0086
	Meat Processing	4				.0001		.0019
	Dairy Processing	5				.0009		.0146
	Other Food Processing	6				.0004		.0144
Fishing & Mining	Seafood Processing	7						.0035
	Mining	8		.0002				
	Fisheries	9						
Forest Products	Forestry	10						
	Logging	11						
	Sawmills	12						
	Veneer-Plywood	13						
	Pulp Mills	14						
	Other Wood Products	15						.0075
Other Industry	Construction	16		.0003	.0050	.0037	.0638	.0147
	Boat Building	17						
	Other Local Mfg.	18		.0016	.0086	.0052		.0034
Trans.	Water Transportation	19						
	Other Transportation	20		.0009	.0020	.0009	.0081	
Trade	Comm. & Util.	21	.0542	.0948	.0199	.0165	.0172	.0342
	Wholesale & Retail	22	.0024	.0055	.0175	.0071	.0243	.1225
	Finance, Insurance	23	.0009	.0045	.0078	.0049	.0109	.0279
	Real Estate	24		.0047	.0997	.0078	.0003	
Services	Hotels & Motels	25					.0080	
	Selected Services	26	.0126	.0198	.0050	.0027	.0019	.0064
	Entertainment	27			.0214			.0089
	Med., Legal, Other	28	.0024	.0132	.0476	.0262	.0438	.0541
Local Payments	Local Government	29	.0738	.0254	.0250	.0254		.0385
	Local Households	30	.7792	.4321	.2348	.7589	.6893	.1201
Payments to	Imports	31	.0724	.3782	.1421	.1385	.1318	.0531 = Savings .3893
	Nonlocal	32	.0018	.0181	.3615			.0735
Total Purchases		a/	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

TABLE 11

The Humboldt County Interdependence Coefficient Table and Output Multipliers

Sector Group, Description and Number			Agriculture						Fishing & Mining			Forest Products					
			Field Crops	Dairies	Other Ag. Prod.	Meat Proc.	Dairy Proc.	Other Food Proc.	Sea-Food Proc.	Mining	Fishing	Forestry	Logging	Sawmills	Veneer & Plywood	Pulp Mills	Other Wood Prod.
Sector Group	Sector Description	Sector No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Agriculture	Field Crops	1	1.0270	.0364	.0148	.0018	.0183	.0148	.0036	.0025	.0036	.0011	.0036	.0025	.0028	.0027	.0024
	Dairies	2	.0094	1.0070	.0093	.0040	.4929	.0111	.0097	.0068	.0098	.0024	.0097	.0066	.0077	.0072	.0067
	Other Ag. Products	3	.0115	.0088	1.0370	.0298	.0060	.0108	.0119	.0084	.0121	.0167	.0119	.0116	.0127	.0096	.0090
	Meat Processing	4	.0025	.0019	.0025	1.0010	.0013	.0025	.0025	.0018	.0026	.0006	.0026	.0017	.0020	.0019	.0017
	Dairy Processing	5	.0192	.0147	.0191	.0082	1.0100	.0228	.0198	.0139	.0202	.0050	.0199	.0136	.0157	.0148	.0134
	Other Food Processing	6	.0189	.0145	.0188	.0081	.0099	1.0300	.0196	.0138	.0199	.0049	.0196	.0134	.0155	.0146	.0133
Fishing & Mining	Seafood Processing	7	.0045	.0034	.0045	.0019	.0023	.0023	1.0050	.0033	.0047	.0012	.0046	.0032	.0037	.0035	.0031
	Mining	8	.0004	.0002	.0003	.0001	.0002	.0002	.0003	1.0000	.0003	.0001	.0003	.0002	.0002	.0004	.0009
	Fisheries	9	.0023	.0018	.0023	.0010	.0012	.0012	.5219	.0077	1.0020	.0006	.0024	.0017	.0019	.0018	.0016
Forest Products	Forestry	10	.0023	.0013	.0043	.0007	.0009	.0010	.0017	.0010	.0015	1.0200	.0034	.2591	.2434	.0578	.0742
	Logging	11	.0011	.0006	.0022	.0003	.0004	.0005	.0008	.0005	.0007	.0007	1.0010	.1348	.1225	.0300	.0378
	Sawmills	12	.0054	.0028	.0137	.0014	.0017	.0020	.0034	.0020	.0029	.0009	.0039	1.0040	.0023	.2222	.1274
	Veneer-Plywood	13	.0019	.0010	.0014	.0005	.0007	.0008	.0014	.0008	.0011	.0003	.0014	.0008	1.0220	.0010	.0459
	Pulp Mills	14	0	0	0	0	0	0	0	0	0	0	0	0	0	1.0000	0
	Other Wood Products	15	.0112	.0082	.0108	.0045	.0056	.0062	.0110	.0077	.0110	.0028	.0111	.0076	.0086	.8084	1.0340
Other Industry	Construction	16	.0412	.0237	.0336	.0128	.0159	.0188	.0367	.0217	.0272	.0103	.0271	.0203	.0223	.0288	.0230
	Boat Building	17	.0002	.0001	.0001	.0001	.0001	.0001	.0343	.0001	.0658	0	.0002	.0001	.0001	.0001	.0001
	Other Local Mfg.	18	.0539	.0191	.0276	.0034	.0104	.0118	.0171	.0051	.0132	.0021	.0340	.0117	.0088	.0071	.0269
Trans.	Water Transportation	19	.0001	.0001	.0001	.0001	.0001	.0024	.0001	.0001	.0001	0	.0002	.0001	.0001	.0002	.0037
	Other Transportation	20	.0049	.0173	.0056	.0566	.0091	.0344	.0122	.0063	.0194	.0132	.0507	.0254	.0119	.1712	.0442
Trade	Comm. & Util.	21	.0803	.0599	.0937	.0397	.0483	.0456	.0650	.0494	.0627	.0188	.0647	.0553	.0536	.1065	.0608
	Wholesale & Retail	22	.1889	.1855	.2025	.0771	.1157	.1196	.1800	.1231	.1827	.0473	.1844	.1657	.1618	.1837	.1565
	Finance, Insurance	23	.0545	.0557	.1138	.0242	.0424	.0296	.0836	.0446	.1081	.0144	.0580	.0466	.0396	.0435	.0399
	Real Estate	24	.0065	.0063	.0093	.0037	.0043	.0125	.0077	.0052	.0089	.0019	.0075	.0056	.0053	.0083	.0199
Services	Hotels & Motels	25	.0011	.0009	.0015	.0003	.0005	.0005	.0006	.0006	.0006	.0006	.0006	.0006	.0006	.0010	.0006
	Selected Services	26	.0216	.0147	.0189	.0076	.0103	.0124	.0151	.0113	.0166	.0048	.0294	.0155	.0150	.0231	.0124
	Entertainment	27	.0119	.0092	.0121	.0051	.0063	.0062	.0124	.0087	.0127	.0031	.0124	.0085	.0097	.0092	.0084
	Med., Legal, Other	28	.0363	.0831	.1086	.0368	.0533	.0492	.0868	.1082	.0863	.0243	.0896	.0643	.0676	.0707	.0634
Local Payments	Local Government	29	.1360	.1067	.1895	.0379	.0677	.0629	.0800	.0722	.0765	.0717	.0699	.0750	.0796	.1229	.0795
	Local Households	30	1.2770	.9751	1.2710	.5451	.6704	.6663	1.3230	.9313	1.3450	.3341	1.3270	.9063	1.0470	.9867	.8947
Multipliers			3.0820	2.6600	3.2289	1.9138	2.6062	1.2515	2.5672	2.4521	3.1182	1.6069	3.0513	2.8618	2.9840	3.1389	2.8054

(Continued on next page)

TABLE 11 (Con't.)

The Humboldt County Interdependence Coefficient Table and Output Multipliers

Sector Group, Description and Number			Other Industry			Transportation		Trade				Services				Local Payments	
			Construc-tion	Boat Blding.	Other Local Mfg.	Water Trans.	Other Trans.	Commun. & Utilities	Whole-Sale & Retail	Finance & Insurance	Real Estate	Hotels & Motels	Selected Services	Enter-tainment	Medical, Legal, Other	Local Gov't.	Local House-holds
Sector Group	Sector Description	Sector No.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Agriculture	Field Crops	1	.0019	.0030	.0028	.0037	.0037	.0024	.0036	.0030	.0037	.0038	.0023	.0019	.0036	.0035	.0043
	Dairies	2	.0051	.0082	.0084	.0101	.0089	.0065	.0103	.0081	.0100	.0104	.0063	.0051	.0102	.0095	.0117
	Other Ag. Products	3	.0068	.0100	.0094	.0125	.0110	.0080	.0121	.0099	.0123	.0127	.0078	.0077	.0120	.0116	.0144
	Meat Processing	4	.0013	.0022	.0021	.0027	.0024	.0017	.0026	.0021	.0026	.0027	.0017	.0013	.0027	.0025	.0031
	Dairy Processing	5	.0103	.0167	.0272	.0208	.0184	.0132	.0211	.0165	.0206	.0213	.0131	.0105	.0210	.0119	.0124
	Other Food Processing	6	.0103	.0165	.0151	.0206	.0183	.0131	.0205	.0163	.0203	.0210	.029	.0103	.0203	.0192	.0238
Fishing & Mining	Seafood Processing	7	.0024	.0039	.0036	.0048	.0043	.0031	.0047	.0038	.0048	.0050	.0031	.0024	.0047	.0045	.0056
	Mining	8	.0089	.0002	.0002	.0004	.0013	.0003	.0003	.0003	.0005	.0003	.0004	.0002	.0003	.0008	.0003
	Fisheries	9	.0013	.0020	.0019	.0025	.0022	.0016	.0026	.0020	.0025	.0026	.0016	.0013	.0025	.0024	.0029
Forest Products	Forestry	10	.0139	.0012	.0169	.0016	.0016	.0013	.0022	.0013	.0018	.0015	.0009	.0010	.0015	.0022	.0016
	Logging	11	.0071	.0005	.0087	.0007	.0008	.0006	.0007	.0006	.0009	.0007	.0005	.0005	.0007	.0011	.0007
	Sawmills	12	.0330	.0022	.0519	.0031	.0034	.0026	.0030	.0027	.0037	.0029	.0019	.0021	.0031	.0046	.0031
	Veneer-Plywood	13	.0202	.0009	.0121	.0013	.0015	.0011	.0012	.0011	.0016	.0012	.0008	.0008	.0012	.0023	.0012
	Pulp Mills	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Other Wood Products	15	.0167	.0091	.0184	.0115	.0104	.0102	.0117	.0092	.0116	.0118	.0074	.0059	.0111	.0114	.0131
Other Industry	Construction	16	1.0160	.0232	.0227	.0384	.0524	.0295	.0298	.0297	.0521	.0327	.0201	.0235	.0138	.0897	.0308
	Boat Building	17	.0001	1.1020	.0001	.0011	.0001	.0002	.0001	.0001	.0002	.0002	.0001	.0001	.0002	.0002	.0002
	Other Local Mfg.	18	.0043	.0058	1.0060	.0086	.0078	.0058	.0094	.0129	.0123	.0074	.0064	.0134	.0124	.0071	.0082
Trans.	Water Transportation	19	.0001	.0001	.0001	1.1320	.0001	.0001	.0004	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001
	Other Transportation	20	.0242	.0077	.0055	.0171	1.0600	.0071	.0091	.0053	.0102	.0050	.0042	.0054	.0053	.0139	.0045
Trade	Comm. & Util.	21	.0416	.0564	.0600	.0174	.0665	1.1010	.0777	.0888	.0722	.1228	.1421	.0564	.0784	.0784	.0707
	Wholesale & Retail	22	.1673	.1458	.1468	.1875	.1768	.1164	1.1750	.1516	.1875	.1865	.1184	.1104	.1809	.1963	.2064
	Finance, Insurance	23	.0318	.0439	.0432	.0662	.0522	.0375	.0555	1.1580	.0591	.0519	.0367	.0356	.0532	.0587	.0562
	Real Estate	24	.0047	.0053	.0053	.0191	.0236	.0057	.0159	.0523	1.0250	.0067	.0094	.1080	.0146	.0075	.0072
Services	Hotels & Motels	25	.0005	.0006	.0006	.0008	.0007	.0005	.0007	.0007	.0008	1.0010	.0006	.0005	.0007	.0085	.0007
	Selected Services	26	.0106	.0115	.0129	.0147	.0125	.0117	.0165	.0197	.0191	.0252	1.0280	.0124	.0144	.0137	.0134
	Entertainment	27	.0064	.0104	.0096	.0130	.0115	.0082	.0129	.0146	.0128	.0132	.0081	.0103	.0125	.0121	.0149
	Med., Legal, Other	28	.0471	.0726	.0755	.0951	.0844	.0671	.0951	.1095	.0987	.0946	.0705	.0968	1.1120	.1267	.0997
Local Payments	Local Government	29	.0606	.0789	.0780	1.0979	.0883	.0705	.0834	.0854	.0939	.1443	.0713	.0653	.0921	1.0670	.0773
	Local Households	30	.6890	1.1160	1.0260	1.3930	1.2290	.8824	1.3490	1.1000	1.3720	1.4190	.8708	.6977	1.3450	1.2980	1.6130
Multipliers			2.2435	2.7568	2.6708	3.1982	2.9541	2.4094	3.0271	2.9038	3.1129	3.2085	2.4636	1.2869	3.0305	3.0554	2.3015

Other Food Processing (sectors 4 and 6, with output multipliers of only 1.91 and 1.25) import most of their inputs ($0.63 and $0.49 per $1.00 of output, Table 10) and therefore create few backward linkages with other local sectors. Forestry (sector 10) has a low multiplier because $0.70 per $1.00 of output leaves the region primarily in the form of payments of rent and profits to nonlocal lumber companies. However, this may be somewhat misleading since the other closely related forest products sectors all have high local impact multipliers because of their high degree of local purchases. Other multipliers have similar interpretations and may be examined by readers with particular interests.

While the output multipliers of Table 11 are useful in judging the local output impact of increases in final demand (exports, including tourist expenditures, or nonlocal government in this case) more relevant multipliers relate to the impact on local household income. Table 12 summarizes the results for two types of local household income multipliers [Miernyk, 1965]. Column (1) of Table 12 shows the direct increase in household income of a $1 increase in final demand for each sector; it is simply the household input-output coefficient for each sector from Table 10. Column (2) shows the direct plus indirect increase in household income resulting from a $1 increase in final demand. As shown in the interdependence Table 11, an increase in final demand for one sector leads to output increases in all other sectors, and therefore increased employment, profits, and other forms of payments to local households in all other sectors. Column (2) shows this total household income impact. The Type I multiplier in Column (4) is simply the ratio of the "direct plus indirect" to "direct" household income generated by a $1 increase in final demand. For example, a $1 increase in Field Crop final demand (exports) would lead directly to $0.6434 additional local income, but indirectly throughout related output expansion would produce a total of $0.7313 of local income. The ratio is 1.14, i.e. $0.14 of indirect income per $1.00 of direct income generated. Dairy Processing has the highest Type I multiplier of 3.68. Seafood Processing (2.25) and Pulp Mills (2.21) are the only other multipliers in excess of 2.00. In all of these cases, there is a strong backward linkage to some other sector (Dairies, Fisheries, Sawmills, Transportation) which account primarily for the large income multipliers.

Table 12 also provides estimates of a more comprehensive income multiplier known as the Type II Income Multiplier. Household income is increased

TABLE 12

Type I and Type II Income Multipliers, by Sector of the Humboldt County Economy

Sector Group	Sector Description	Sector Number	Direct[a/] Income Change (1)	Direct and[b/] Indirect Income Change (2)	Type I Income Multiplier (4) = (2) ÷ (1)	Direct, indirect and[c/] induced income change (3)	Type II Income Multiplier (5) = (3) ÷ (1)
Agriculture	Field Crops	1	.6434	.7313	1.14	1.2770	1.98
	Dairies	2	.4336	.5564	1.28	.9751	2.25
	Other Ag. Products	3	.5442	.6851	1.26	1.2710	2.34
	Meat Processing	4	.2586	.3284	1.27	.5451	2.11
	Dairy Processing	5	.1051	.3871	3.68	.6704	6.38
	Other Food Proc.	6	.2864	.3883	1.36	.6663	2.33
Fishing & Mining	Seafood Processing	7	.3592	.8065	2.25	1.3230	3.68
	Mining	8	.5003	.5551	1.11	.9313	1.86
	Fisheries	9	.7206	.8241	1.14	1.3450	1.87
Forest Products	Forestry	10	.1375	.1625	1.18	.3341	2.43
	Logging	11	.7358	.8171	1.11	1.3270	1.80
	Sawmills	12	.3187	.5366	1.68	.9063	2.84
	Veneer-Plywood	13	.4535	.6255	1.38	1.0470	2.31
	Pulp Mills	14	.2494	.5510	2.21	.9867	3.96
	Other Wood Products	15	.3107	.5251	1.69	.8947	2.88
Other Industry	Construction	16	.2802	.4050	1.45	.6890	2.46
	Boat Building	17	.6570	.6716	1.02	1.1160	1.70
	Other Local Mfg.	18	.5450	.6128	1.12	1.0260	1.88
Trans.	Water Trans.	19	.6958	.8378	1.20	1.3930	2.00
	Other Trans.	20	.6468	.7383	1.14	1.2290	1.90
Trade	Comm. & Util.	21	.4702	.5241	1.11	.8824	1.88
	Wholesale & Retail	22	.7823	.8205	1.05	1.3490	1.72
	Finance, Insurance	23	.4911	.6553	1.33	1.1000	2.24
	Real Estate	24	.7673	.8277	1.08	1.3720	1.79
Services	Hotels & Motels	25	.7792	.8186	1.05	1.4190	1.82
	Selected Services	26	.4321	.5161	1.19	.8708	2.02
	Entertainment	27	.2348	.4068	1.73	.6977	2.97
	Med., Legal, Other	28	.7589	.8119	1.07	1.3450	1.77

a/ Household coefficients from Table 10.

b/ Sum of inverse coefficients of Table 11 multiplied by corresponding household coefficients shown in Column (1).

c/ Inverse coefficients of household sector in household endogenous model.

directly and indirectly by output increases associated with a $1 increase in final demand as shown in the Type I multiplier. However, a substantial proportion of this additional local income is spent within Humboldt County (approximately 50 percent as shown in Table 10), which in turn creates additional multiplier effects through increased demands on local industries. This additional impact is called the "induced" income effect. Column (3) shows the total "direct, indirect plus induced" income change associated with a $1 increase in final demand for each sector. The ratio of this effect to the simple direct effect gives the type II multiplier in Column (5): for example, a $1 increase in final demand (exports) of Field Crops would provide a total of $1.2770 in local income — $0.6434 "directly," $0.0879 "indirectly" ($0.7313 - $0.6434) and $0.5457 in "induced" form ($1.2770 - $0.7313). The total local impact is 1.98 times the direct impact($1.2770 - $0.6434). The large "induced" effects, as shown by the substantial increases in Type II over Type I multipliers, are an important source of local income generation from increases in final demand.

Projections of the Humboldt County Economy to 1980

Input-output analysis often distinguishes between "basic" industries (those with substantial exports) and "nonbasic" industries (those serving primarily local markets). From the transactions table developed in this study it is clear that the "basic" industries of Humboldt County are primarily those directly dependent on natural resources (lumber, fisheries, tourism, agriculture). Declining supplies of lumber and fish, together with environmental pressures for conservation of the remaining natural resources, seem likely to reduce output in their sectors. On the other hand, tourism is likely to increase. The purpose of this section is to systematically examine the impact on county income, employment and per capita income of alternative output projections for the "basic" sectors of Humboldt County. In addition to changes in output in these sectors, a critical factor in influencing county employment is the rate of labor-saving technological change in the various sectors. Thus, potential changes in output per worker are projected and are used in conjunction with the input-output model to project employment. The year 1980 is a convenient base year for medium-term projections since national projections are available for that date.

The sections to follow examine (1) the mathematical model used for projections, (2) projections of changes in output per worker by sector to 1980, (3) 1980 projections of outputs or final demands for each sector of Humboldt County under alternative assumptions, and (4) the 1980 projected county income, employment and per worker income for each projection set.

Mathematical Formulation

The standard use of input-output analysis for projection purposes assumes that the final demand for each sector is given exogenously, and the levels of sector outputs required to meet this level of final and related intermediate demand are determined. In matrix notation, the transactions relationship is written:

$$(1)\quad X - AX = Y^{o},$$

where Y^{o} is a set of projected final demands, A is the projected input-output coefficient matrix, and X is the level of sector outputs. Solution of the system for the required levels of X to meet final demands Y^{o} is given by equation (2).

$$(2)\quad X = [1-A]^{-1}Y^{o}.$$

However, in Humboldt County the level of sector outputs in the so-called natural resource sectors (forestry, fisheries, agriculture) will be determined more directly by availability of resource supplies and environmental controls than by the level of final demand for exports of the region. For example, even if there were a prolonged housing boom in the United States leading to a high sustained demand for lumber, the lumber production in Humboldt County would decline over time due to dwindling raw material supplies. To a large extent, a similar argument is true of fisheries and agriculture, where local production is likely to proceed relatively unaffected by change in the level of demand for its exports.

For these reasons, the 1980 projections of the Humboldt economy are based on (1) projecting sector outputs directly for forestry, fishing and agriculture, based on resource availability and prospective environmental policies, and (2) projecting final demands for remaining sectors. The mathematics of this case is perhaps most easily illustrated with a hypothetical 4-sector model in which sectors 3 and 4 are "natural resource" sectors and sectors 1 and 2 are "local service" sectors. The outputs of

sectors 3 and 4 (X_3^o and X_4^o) as well as the final demand estimates for sectors 1 and 2 (Y_1^o, Y_2^o) are projected exogenously. The set of equations is:

$$(3)\quad \begin{aligned} X_1 - (a_{11}X_1 + a_{12}X_2 + a_{13}X_3^o + a_{14}X_4^o) &= Y_1^o \\ X_2 - (a_{21}X_1 + a_{22}X_2 + a_{23}X_3^o + a_{24}X_4^o) &= Y_2^o \\ X_3^o - (a_{31}X_1 + a_{32}X_2 + a_{33}X_3^o + a_{34}X_4^o) &= Y_3 \\ X_4^o - (a_{41}X_1 + a_{42}X_2 + a_{43}X_3^o + a_{44}X_4^o) &= Y_4. \end{aligned}$$

Rearranging terms in the first two equations we have:

$$(4)\quad \begin{aligned} X_1 - (a_{11}X_1 + a_{12}X_2) &= Y_1^o + (a_{13}X_3^o + a_{14}X_4^o) \\ X_2 - (a_{21}X_1 + a_{22}X_2) &= Y_2^o + (a_{23}X_3^o + a_{24}X_4^o). \end{aligned}$$

The right hand side of the equations are constants. Let us define these constants as F_1 and F_2. Then in matrix notation, system (4) can be written as:

$$(5)\quad X_1^* - A_{11}X_1^* = F \quad \text{where } X_1^* = \begin{pmatrix} X_1 \\ X_2 \end{pmatrix} \text{ and } A_{11} = \begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix}.$$

To solve we perform the usual inversion and multiplication:

$$(6)\quad X_1^* = [1-A_{11}]^{-1}F.$$

The solution values of X_1 and X_2 from (6) are substituted in the last two equations of (3), which are then solved for Y_3 and Y_4. The procedure for this 4-sector case is easily generalized to n sectors (see Appendix B).

Projections of Output per Worker, by Sector, to 1980

Input-output tables reflect the average technology prevailing in each industry at a point in time. Since technological change is a pervasive phenomenon in American industry a serious problem in using input-output models for long-term projections is how to correct the input-output coefficient structure of the table to reflect expected technological changes. One possibility is to assume that the average firm in the future will use the technology currently employed by a sample of the most advanced firms — so-called "best practices" technology [e.g., see Mierynk, 1970]. In this study, however, technological change is handled in a very elementary way. We assume that technological change takes place by "learning by doing" and

that wage increases match increases in labor productivity (average product per worker).

Table 13 shows the approach in some detail. Columns (1) through (4) summarize, by the sector breakdown used in Humboldt County, the projected annual percentage changes in output, employment and output per worker in the comparable United States sector [U.S. Bureau of Labor Statistics, 1972], based on a trend toward a "services" economy with four percent unemployment. Column (5) shows the calculated annual percentage change in output per worker based on the data in columns (1) and (2); in general, these "exact" estimates correspond closely to the ranges of productivity increase shown in column (4). Given the 1969 Humboldt County output (column 6) and total employment (column 9), by sector, the current (1969) output per worker was calculated (column 10). The 1980 projected output per worker (column 11) by sector was then projected multiplying the annual percentage increase in output per worker (column 5) compounded over the 11 year period 1969 to 1980 by the 1969 output per worker.

If the projections in Table 13 are accurate, they show a very substantial increase in output per worker over the decade of the 1970's. It is reasonable to suppose that this increased productivity is a result of many forces acting simultaneously: changes in machinery and other material inputs, increased education and skills of workers, and greater experience with given production processes leading to greater output even with the same labor inputs and techniques of production (learning by doing). The assumption of this study is that the increase in output per worker comes primarily from the latter two categories. In fact, no change in material inputs is assumed, such that the input-output coefficient matrix for 1969 is used unchanged for 1980. The total payment to labor per unit of output also remains constant. Since output per worker is increasing, however, the labor payment coefficients remain constant only if wages increase by the same percentage as output per worker. While these assumptions are somewhat extreme, the authors feel that they may be just as realistic as a wholesale revision of the input-output coefficient table based on a host of technological assumptions for each industry. Past studies have shown that input-output structures change rather slowly over time [Carter, A., 1970]. Since a principal reason for the projections is to estimate employment, concentrating on changes in labor productivity alone may be justified.

TABLE 13

Estimated 1969 and Projected 1980 Humboldt County Output per Worker Based on U.S. Projections Which Assume a Trend Toward a Services Economy with 4 Percent Unemployment

Sector Name	Sector Number	Percentage Annual Increase In Domestic Output (1)	Percentage Annual Change In Total Employment (2)	Percentage Annual Change In Wage and Salaried Workers (3)	Percentage Annual Change In Domestic Output Per Worker (4)	Implied Annual Percentage Change In Domestic Output Per Worker (5)	Humboldt County Domestic Output (6)
		percent					$1,000
Field Crops	1	3.0	-2.9	-2.7	>3.6	6.08	1,234
Dairies	2	3.0	-2.9	-2.7	>3.6	6.08	8,071
Other Ag. Prod.	3	3.0	-2.9	-2.7	>3.6	6.08	4,031
Meat Proc.	4	2.8	-2.9	-1.7	>3.6	5.87	781
Dairy Proc.	5	3.3	-1.0	1.0	2.6-3.5	4.34	14,343
Other Food Proc.	6	3.3	-1.0	1.4	2.6-3.5	4.34	5,805
Seafood Proc.	7	3.3	-1.0	-1.0	2.6-3.5	4.34	14,082
Mining	8	3.4	-0.9	-0.3	2.6-3.5	3.65	2,838
Fisheries	9	2.0	1.0	-2.7	≤2.5	0.99	7,338
Forestry	10	2.0	1.0	-2.7	≤2.5	0.99	39,096
Logging	11	3.4	0.1	-1.5	>3.6	3.30	20,335
Sawmills	12	3.4	0.1	-2.2	>3.6	3.30	124,189
Veneer-Plywood	13	3.4	0.1	1.5	>3.6	3.30	28,233
Pulp Mills	14	3.4	0.1	2.3	>3.6	3.30	59,361
Other Wood Prod.	15	3.4	0.1	2.3	>3.6	3.30	9,540
Construction	16	4.2	2.1	1.5	≤2.5	2.06	17,797
Boat Building	17	2.9	1.6	1.7	≤2.5	1.28	487
Other Local Mfg.	18	3.3	1.3	1.5	≤2.5	1.97	19,929
Water Trans.	19	3.9	0.8	1.2	2.6-3.5	3.08	3,518
Other Trans.	20	3.9	0.8	0.9	2.6-3.5	3.08	17,306
Commun. and Util.	21	6.6	0.8	1.4	>3.6	5.75	25,559
Wholesale and Retail	22	4.6	1.9	2.2	2.6-3.5	2.65	64,245
Fin. and Insurance	23	4.3	2.3	2.5	≤2.5	1.96	22,232
Real Estate	24	4.9	1.3	1.7	>3.6	3.55	3,576
Hotels and Motels	25	4.5	2.0	3.0	2.6-3.5	2.45	4,444
Selected Services	26	4.7	1.8	2.2	2.6-3.5	2.85	12,964
Entertainment	27	4.3	2.2	1.3	≤2.5	2.05	4,953
Med., Legal, Other	28	5.3	3.7	4.4	≤2.5	1.54	28,506
Local Gov.	29	5.4	3.9	4.0	n.a.	1.44	42,797
Nonlocal Gov.	32	5.0	1.5	3.0	n.a.	3.45	76,740

(Continued on next page)

TABLE 13 (Con't.)

Estimated 1969 and Projected 1980 Humboldt County Output Per Worker Based on U.S. Projections Which Assume a Trend Toward a Services Economy with 4 Percent Unemployment

Sector Name	Sector Number	Humboldt County Employment 1969			Estimated Humboldt County	Estimated Humboldt County
		Insured Employment (7)[c]	Non-Insured Employment (8)[d]	Total Employment (9)	1969 Domestic Output Per Worker (10)	1980 Domestic Output Per Worker (11)[e]
		number			dollars	
Field Crops	1		60	60	20,567	39,368
Dairies	2	1	570	571	14,135	27,056
Other Ag. Prod.	3	96	1228	1324	3,045	5,828
Meat Proc.	4	10		10	78,100	146,269
Dairy Proc.	5	146		146	98,240	156,764
Other Food Proc.	6	138		138	42,065	67,124
Seafood Proc.	7	497		497	28,334	45,213
Mining	8	2	13	15	189,200	579,936
Fisheries	9	146	354	500	14,676	16,356
Forestry	10	42		42	930,857	1,037,397
Logging	11	960		960	21,182	30,274
Sawmills	12	5346		5346	23,230	33,201
Veneer-Plywood	13	1826		1826	15,462	22,099
Pulp Mills	14	398		398	149,148	213,167
Other Wood Prod.	15	207		207	46,087	65,869
Construction	16	879	321	1200	14,831	18,560
Boat Building	17	28		28	17,393	20,005
Other Local Mfg.	18	24	628	652	30,566	37,882
Water Trans.	19	51	106	157	22,408	31,284
Other Trans.	20	855	345	1200	14,422	20,135
Commun. and Util.	21	854		854	29,929	55,357
Wholesale and Retail	22	5932	1468	7400	8,682	11,576
Fin. and Insurance	23	599	152	751	29,603	36,649
Real Estate	24	174	75	249	14,361	25,387
Hotels and Motels	25	356	343	699	6,358	8,298
Selected Services	26	898	623	1521	8,523	11,610
Entertainment	27	331	230	561	8,829	11,037
Med. and Legal	28	1378	2141	3519	8,106	9,590
Local Gov.	29	8	2092	2100	20,380	23,851
Nonlocal Gov.	32	-	5600	5600	13,704	19,910

Sources and Computations by column of table:

Col. (1): U.S. Bureau of Labor Statistics [1972, Table A-11, p. 45-46]. Rates of increase in Humboldt County sectors assumed equal to same or most nearly comparable U.S. sector.

Col. (2): U.S. Bureau of Labor Statistics [1972, Table A-19, p. 51-52].

Col. (3): U.S. Bureau of Labor Statistics [1972, Table A-22, Average Annual rate of change, 1965-80].

Col. (4): U.S. Bureau of Labor Statistics [1972, Table A-15].

Col. (5): $\frac{1.0 + \text{Col. (1)}}{1.0 + \text{Col. (2)}} - 1.0 = \text{Col. (5)}$

Col. (6): From Humboldt County Input-Output table, this report.

Col. (7): California Department of Human Resources Development [1970].

Col. (8): U.S. Bureau of Census [1970].

Col. (9): Col. (7) + Col. (8) = Col. (9).

Col. (10): $\frac{\text{Col. (6)}}{\text{Col. (9)}} = \text{Col. (10)}$.

Col. (11): Col. (10) x $[1.0 + \text{Col. (5)}]^{11}$ = Col. (11).

Projections of Outputs or Final Demands to 1980, by Sector

As indicated in the mathematical section, the outputs are projected directly to 1980 for the key natural resource based sectors, while the components of final demand are projected for the remaining sectors. Table 14 shows the detailed 1980 projections for the base model, with comparison to 1969. Details of the projection procedures are given below, first for those sectors whose output was projected.

Sector 1. Field Crops: Projection to 1980 was based on a simple regression analysis of trends for individual crop production data from 1959 to 1971. Projected 1980 production was valued at 1969 prices.

Sector 2. Dairies: Milk production, by grade, was projected to 1980 [personal communication, Robert Abbott, Senior Economist with California Bureau of Milk Stabilization]. Projected production was valued at 1969 prices, by grade.

Sector 3. Other Agricultural Production: Projection to 1980 was based on simple regression analysis of trends for beef cattle and several minor commodities. The mix of animals (cows, steers, bulls, and calves) within the beef category was assumed constant. Projected production was valued at 1969 prices.

Sector 4. Meat Processing: Projection to 1980 was based on the projected numbers of meat animals in sector 3.

Sector 5. Dairy Processing: Projections to 1980 were based on the projected milk production in sector 2.

Sector 7. Seafood Processing: Projection to 1980 was based on the output of fisheries in sector 9.

Sector 8. Mining: Projected 1980 output was based on the Bureau of Labor Statistics study [U.S. Department of Labor, 1970] average annual rate of change in mining output in the United States (2.9 percent per year).

Sector 9. Fisheries: Projected 1980 output was based on simple regression analysis of trends in total pounds of fish landed in the Eureka area from 1961 to 1970 [California Department of Fish and Game, 1970]. Projected output was valued at 1969 prices.

TABLE 14

Output and Components of Final Demand for the Humboldt County Economy, 1969 and Projected to 1980 for the Base Model

Sector Group	Sector Description	Sector Number	1969					1980 projections for "base" model					Ratio of 1980 Output or final demand to 1969	
				Final Demand					Final Demand					
			Output	Exports	Nonlocal government	Recreation	Total	Output	Exports	Nonlocal government	Recreation	Total	Output	Total final demand
			$1,000									$1,000		
Agriculture	Field Crops	1	1,234	0	0	0	0	2,251	-	-	-	-	1.82	-
	Dairies	2	8,071	1,071	0	0	1,071	8,479	-	-	-	-	1.05	-
	Other Ag. Products	3	4,031	0	0	0	0	5,668	-	-	-	-	1.41	-
	Meat Processing	4	781	0	0	0	0	926	-	-	-	-	1.19	-
	Dairy Processing	5	14,343	8,433	0	0		15,608	-	-	-	-	1.09	-
	Other Food Processing	6	5,805	0	0	0	0	-	0	0	0	0	-	1.00
Fishing and Mining	Seafood Processing	7	14,082	12,721	0	0	12,721	19,516	-	-	-	-	1.39	-
	Mining	8	2,838	2,664	0	0	2,664	4,190	-	-	-	-	1.48	-
	Fisheries	9	7,338	14	0	0	14	10,170	-	-	-	-	1.39	-
Forest Products	Forestry	10	39,096	47	0	0	47	30,359	-	-	-	-	0.78	-
	Logging	11	20,335	157	0	0	157	16,016	-	-	-	-	0.78	-
	Sawmills	12	124,189	108,260	0	0	108,260	96,473	-	-	-	-	0.78	-
	Veneer-Plywood	13	28,233	26,694	0	0	26,694	21,933	-	-	-	-	0.78	-
	Pulp Mills	14	59,361	59,361	0	0	59,361	46,128	-	-	-	-	0.78	-
	Other Wood Products	15	9,540	5,886	0	0	5,886	7,415	-	-	-	-	0.78	-
Other Industry	Construction	16	17,797	0	7,980	0	7,980	-	0	10,470	0	10,470	-	1.31
	Boat Building	17	487	0	0	0	0	-	0	0	0	0	-	1.00
	Other Local Mfg.	18	19,929	16,478	0	0	16,478	-	25,367	0	0	25,367	-	1.54
Transportation	Water Transportation	19	3,518	3,043	0	0	3,043	-	5,315	0	0	5,315	-	1.75
	Other Transportation	20	17,306	1,825	626	0	2,451	-	3,187	821	0	4,008	-	1.64
Trade	Comm. & Util.	21	25,559	0	291	0	291	-	0	382	0	382	-	1.31
	Wholesale & Retail	22	64,245	0	2,670	5,003	7,673	-	0	3,503	10,744	14,247	-	1.86
	Finance, Insurance	23	22,232	0	4,588	0	4,588	-	0	6,020	0	6,020	-	1.31
	Real Estate	24	3,576	374	322		696	-	640	422	0	1,062	-	1.53
Services	Hotels & Motels	25	4,444	0	0	4,100	4,100	-	0	0	8,804	8,804	-	2.15
	Selected Services	26	12,964		7,182	610	7,792	-	0	9,423	1,310	10,733	-	1.37
	Entertainment	27	4,953	0	0	1,235	1,235	-	0	0	2,653	2,653	-	2.14
	Med., Legal, Other	28	28,506	1,008	106	0	1,114	-	1,636	139	0	1,775	-	1.59
Local payments	Local Government	29	42,797	0	12,793	0	12,793	-	0	16,786	0	16,786	-	1.31
	Local Households	30	383,185	22,631	40,182	0	62,813	-	22,631	52,722	0	75,353	-	1.19

Sources: 1969 data from Table 10. Adjusted for addition of a recreation sector to final demand. 1980 data projected by various methods and from various sources. See text for details.

Sectors 10-15. Forest Products: Projected forestry output (sector 10) in the base model was based on a study by Brodie [1970] of alternative forestry harvest levels. All the related sectors (11 through 15) are assumed to increase proportionately to forestry, since it provides the basic raw materials for the forest products sector.

A number of long-range projections have been made for the forestry sector in the north coast of California. One of the most recent, which pertains specifically to Humboldt County, was made as part of a larger study by Brodie [1970]. Table 15 shows 1965, 1969 and three projected levels of harvest, including two by Brodie. The actual level of harvest declined 24 percent between 1965 and 1969 (primarily in whitewood) from 1,351 mil board feet to 1,025 mil board feet. Projection A is the lowest reasonable estimate currently available [K.S. Fowler, private communication, 1972]. Projection B is Brodie's alternative 4, which assumes that public harvests of whitewood will be used to compensate for declining availability of private whitewood. This intermediate level of cut was used as the projected 1980 level of output of the forestry sector in the base model projections of Table 14. This alternative represents an abandonment of sustained yield on public lands because the higher output could only be temporarily maintained. Through intensified forest management this alternative would allow a gradual (rather than abrupt) decrease in total harvest. However, the greater temporary increase in the public cut merely postponed drastic reductions in raw material availability. Brodie believed that the increase in public cut was the maximum likely to be politically feasible.

Projection C assumes the same high level of public cut as projection B, but a higher rate of private cut. Brodie's other alternative 1975-85 projections, not used here, ranged from 30 percent to 100 percent of the 1965 harvest. All alternatives near 100 percent of the 1965 level would have resulted in severe depletion of the public and/or private stocks. While Brodie is not entirely clear on this point, the 30 percent cutting rate in the 1975-85 period appears to permit sustained and perhaps increasing yields beyond 1985. The alternative rates chosen for examination in this study, although substantially lower than 1965, still do not appear to promise a sustained yield after 1980. For the remaining sectors, final demand rather than output was projected. Table 14 shows the projections for the three components of final

TABLE 15

Projected Forestry Output for Humboldt County in 1980, Under Three Alternative Assumptions

	Private timber		Public timber	Total harvest
	Redwood	Whitewood	Whitewood	
	(million board feet)			
1965 level[a/]	400	776	175	1,351
1969 level[b/]	467	558[f/]	[f/]	1,025
1980 projection A[c/]	n.a.	n.a.	n.a.	700
1980 projection B[d/]	400	124	381	905
1980 projection C[e/]	400	313	381	1,094

a/ From Brodie [1970] as reported by K.S. Fowler [1972].

b/ From current study.

c/ From personal communication with K.S. Fowler [1972].

d/ From Brodie [1970, alternative 4] as reported in K.S. Fowler [1972].

e/ From Brodie [1970, alternative 8] as reported in K.S. Fowler [1972].

f/ Includes both private and public whitewood.

demand: exports, nonlocal government, and recreation-tourism -- a new sector.

In making the long-term projections, the I-O table was revised to include recreation and tourism as a sector, using input-output coefficients based on the expenditure data shown above, and with corresponding adjustments in the sectors from which these expenditures were deducted to form the new sector.

Projecting recreation and tourism is particularly difficult, partly because there is no single sector which clearly encompasses this activity. After reviewing the current literature on tourist expenditures [Drake, et al., 1968, Stoevener, et al., 1972, Bromley, et al., 1968, Kalter, 1967, and Clawson and Knetsch, 1966], it was decided that recreation and tourism result in purchases primarily from I-O table sectors 22 (wholesale and retail trade), 25 (hotels and motels), 26 (selected services), and 27 (entertainment). To arrive at an output figure for recreation and tourism, a visitor-days figure of 2,000,000 estimated by the National Park Service was utilized [Humboldt County, California, 1969b]. Since this is a 1964 figure, it is probably biased in a downward direction. The total visitor-days was then disaggregated into its three major components or use types; campers, day-users, and motel and lodge users. Based on our export total for hotels and motels, and using an expenditure per visitor-day for lodging of $6.50 ($13.00/night double occupancy) a motel visitor-day total of 630,000 was estimated. Camper use was estimated at 740,000, based on the county overall Economic Development Plan [Humboldt County, California, 1969b] and cross-checked with State Division of Parks and Recreation data. The residual of 630,000 visitor-days was assigned to day users. Using daily expenditure figures (increased 25 percent for inflation) from a study of Tuolumne County [Drake, et al., 1968] a total expenditure figure for each type of use was estimated. Using the Drake et al. coefficients, these expenditure totals were then disaggregated into retail purchases, selected services purchases, lodging, and entertainment. The calculated entertainment figure was low in relation to the exports figure for entertainment in sector 27 of the I-O table; therefore, the higher figure (exports) was used for this component. Hotels and motels expenditures were also assumed equal to the exports (sector 25) in the I-O table. Since retail and selected services were importing sectors for the county, the recreation expenditures in this sector were subtracted from the households sector. Estimated tourist retail purchases

constituted 11 percent of total household retail purchases and 25 percent of selected services. The above calculations gave the following estimated 1969 expenditures for a recreation and tourist sector as shown in Table 14.

Retail & Wholesale Trade	$5.0 mil
Hotels & Motels	4.1 mil
Selected Services	0.6 mil
Entertainment	1.2 mil
Total	$10.9 mil

The number of visitor-days of recreation has been projected to increase to four million by 1980 [Humboldt County, California, 1969b], double the two million figure used for 1969. Added to this figure is 330,000 visitor-days of recreation at Butler Valley Dam [U.S. Army Corps of Engineers, 1968]. The distribution of expenditures by tourists was assumed to remain at the 1969 levels, leading to the 1980 projected recreation-tourism expenditures shown in Table 14.

The nonlocal government component of final demand was projected using the Bureau of Labor Statistics (BLS) United States projection [U.S. Department of Labor, 1970] average annual rate of change in government expenditures of 2.5 percent. The distribution of this increased expenditure was distributed among sectors in the 1969 proportions.

The other components of final demand, exports, were assumed to increase in each sector in proportion to the projection of the total demand for that product in the United States. Total United States demand increase was estimated as equal to the average annual rate of growth of output, by sector, from the BLS projections mentioned above.

1980 Input-Output Model Projections of the Humboldt County Economy

Given the projections to 1980 of output or final demand for each sector of the Humboldt County economy, the input-output model was used to project 1980 county income, employment and income per worker. The total projections were made first for a "base model" and then for variations in output projections for each of the key natural resource sectors (forest products, fisheries, recreation-tourism), and for variations in the key exogenous sector, nonlocal (state and federal) government. Alternative projections of

employment and income per worker were made based on the assumption first of no technological change (i.e., output per worker in each industry remaining at the 1969 level) and then assuming rates of technological change in each sector equal to rates projected for the United States by the U.S. Department of Labor [1970], as described earlier.

The initial 1980 input-output model projection is called the 1980 Base Model, which uses the 1980 projections of output or final demand for each sector developed in the preceding section. The forestry sector output was set at intermediate projection B (905 MBF) or about 22 percent less than the 1969 harvest level of 1,166 MBF. Although there is no objective basis for evaluating the probabilities that the various sector projections will be accurate, the subjective judgment of the authors is that the 1980 Base Model represents a quite reasonable set of assumptions about likely developments in the economy. However, experience with long-range projections has shown that they seldom fully anticipate new developments which will occur. It is well to view the current projections in this light. A principal advantage of the input-output approach, however, is that in addition to providing some fairly detailed perspectives on the current and projected economy, it provides a tool which can be readily used by interested county or state agencies, or by private industry to test out the consequences of alternative assumptions and policies.

Table 16 summarizes the results of the various projection models. The 1980 Base Model provides a county household income of $426 mil compared to $388.8 mil in the 1969 base year for the input-output model (1969 prices used throughout so that comparisons are in real terms). Thus, despite a 22 percent decline in forestry output, expected increases in output in other sectors provide a slight increase (about 10 percent) in county income. With no technological change in each sector (constant 1969 output per worker) total county employment would increase from 38,531 to 43,274, or about 13 percent. (County employment increases relatively more than county income due to changes in the mix of output by 1980, as well as different rates of productivity change in each sector.) Average income per employee would decline slightly, from $10,090 to $9,844. Caution is required in interpreting the term "average income per employee." It is calculated simply as total household income divided by employment. Since household income includes all payments to local factor owners (rent, depreciation, interest and profit as well as wages and salaries) it is not simply the wages earned by the average

TABLE 16

Alternative Input-Output Model Projections of the Humboldt County Economy to 1980:
Total Household Income, Employment, and Income per Employee, with and without Technological Change

Sector examined in detail	Specific projection model[a/]	Humboldt County Totals			Average income per employee	
		Household income	Employment			
			With no technological change	With technological change	With no technological change	With technological change
		$ mil.	number		dollars	
Current (1969) situation		388.8	38,531	-	10,090	-
Forest Products	1980 Base Model	426.0	43,274	31,797	9,844	13,397
	Forestry[b/] Projection A	402.9	40,392	29,525	9,975	13,646
	Forestry[c/] Projection C	456.5	46,202	33,769	9,881	13,518
Fisheries	1980 Base Model	426.0	43,274	31,797	9,844	13,397
	Fisheries (-50%)	413.5	42,105	30,724	9,821	13,459
	Fisheries (+100%)	450.9	45,672	33,409	9,873	13,496
Recreation-tourism	1980 Base Model	426.0	43,274	31,797	9,844	13,397
	Rec.-tour. (-50%)	411.6	41,177	30,021	9,996	13,710
	Rec.-tour. (+100%)	454,9	47,474	34,826	9,582	13,062
Nonlocal government	1980 Base Model	426.0	43,274	31,797	9,844	13,397
	Government (-50%)	361.1	36,225	26,418	9,968	13,669
	Government (+100%)	556.0	59,397	43,420	9,361	12,803

a/ "Base" model assumes Forestry Projection B (905 MFB), and all other sector outputs or final demands at projected levels indicated in text.

b/ Forestry Projection A = 700 MBF.

c/ Forestry Projection C = 1,094 MBF.

employee. Rather it is a rough index of per capita income in the area, and perhaps most useful to be used in a comparative sense among model solutions.

It is highly unrealistic, however, to assume no technological change (change in output per worker). If United States rates of change in labor productivity are applied to each sector, the total county employment picture changes sharply. The 1980 Base Model would show a decline in employment to 31,797, about 17 percent below the 1969 level of 38,531. Income per worker, however, would increase correspondingly to $13,397.

Table 17 provides a more detailed breakdown of the 1980 Base Model projection by sector. Without technological change employment in every sector increases proportionately with output between 1969 and 1980. Therefore, employment would increase in every sector except the forestry products sectors (10-15) and other transportation (sector 20) which is heavily dependent on the lumber industry. However, with United States rates of technological change, employment would decline in all but six sectors (fisheries, boat building, other local manufacturing, water transportation, hotels and motels, and entertainment) between 1969 and 1980.

Table 17 also provides an estimate of the local value added per employee (roughly equal to household income per employee) in each sector in 1969 and projected for 1980. Of course, value added per employee tends to be high in sectors where labor is a minor input relative to various forms of capital (land, machinery, mineral deposits). Thus, mining and forestry have the largest household income per employee. Conversely, household income is relatively low in the labor intensive service sectors.

The upper section of Table 16 shows the results of using the alternative forestry harvest projections in association with the 1980 Base Model projections for other sectors. Reducing the lumber cut to 700 MBF as assumed in Forestry Projection A (Table 15) leads to a county income of $402.9 mil and employment with and without productivity change of 29,525 and 40,392, respectively. Forestry Projection C with a 1980 harvest quite close to the 1969 level would provide a much more optimistic picture. Still, with technological change the level of county employment would be substantially less in 1980 than in 1969 (33,769 versus 39,531). Thus, it is apparent that the rate of technological change will be at least as important as changes in the output of the forestry industry in determining employment and income per worker.

TABLE 17

Comparison of 1969 and 1980 Base Model Output, Employment, Household Income and Household Income per Employee, by Sector

Sector Group	Sector Description	Sector Number	Gross Output		Total Employment			Household income		Household income per employee	
			1969	1980[a/]	1969	1980 Without Tech. change	1980 With Tech. change	1969	1980	1960 and 1980 without Tech. change	1980 with Tech. change
			$1,000		number			$1,000		dollars	
Agriculture	Field Crops	1	1,234	2,251	60	109	57	794	1,448	13,233	25,404
	Dairies	2	8,071	8,479	571	600	313	3,500	3,676	6,130	11,744
	Other Agr. Production	3	4,031	5,668	1,324	1,861	973	2,194	3,085	1,657	3,171
	Meat Processing	4	781	926	10	12	6	202	239	20,200	39,833
	Dairy Processing	5	14,343	15,608	146	159	100	1,508	1,640	10,329	16,400
	Other Food Processing	6	5,805	6,315	138	150	67	1,663	1,809	12,051	27,000
Fishing and Mining	Seafood Processing	7	14,082	19,516	497	689	432	5,053	7,010	10,167	16,227
	Mining	8	2,838	4,190	15	22	7	1,420	2,096	94,667	299,428
	Fisheries	9	7,338	10,170	500	693	622	5,288	7,329	10,576	11,783
Forest Products	Forestry	10	39,096	30,359	42	33	29	5,377	4,174	128,024	143,931
	Logging	11	20,335	16,016	960	756	529	14,964	11,785	15,588	22,278
	Sawmills	12	124,189	96,473	5,346	4,153	2,906	39,587	30,746	7,405	10,580
	Veneer-Plywood	13	28,233	21,933	1,826	1,419	992	12,805	9,947	7,012	10,027
	Pulp Mills	14	59,361	46,128	398	309	216	14,807	11,504	37,204	53,259
	Other Wood Products	15	9,540	7,415	207	161	113	2,965	2,304	14,324	20,389
Other Industry	Construction	16	17,797	21,300	1,200	1,436	1,148	4,987	5,968	4,156	5,199
	Boat Building	17	487	675	28	39	34	320	443	11,428	13,029
	Other Local Mfg.	18	19,929	28,910	652	946	763	10,862	15,756	16,660	21,835
Transportation	Water Transportation	19	3,518	6,083	157	271	194	2,448	4,233	15,592	21,820
	Other Transportation	20	17,306	16,360	1,200	1,134	813	11,194	10,582	9,328	13,016
Trade	Communication & Util.	21	25,559	27,210	854	909	492	12,020	12,794	14,075	26,004
	Wholesale-Retail Trade	22	64,245	79,030	7,400	9,103	6,827	50,264	61,825	6,792	9,056
	Finance, Insurance	23	22,232	25,270	751	854	690	10,920	12,410	14,541	17,986
	Real Estate	24	3,576	4,409	249	307	174	2,744	3,383	11,020	19,442
Services	Hotels & Motels	25	4,444	9,189	699	1,445	1,107	3,463	7,160	4,954	6,468
	Selected Services	26	12,964	16,690	1,521	1,958	1,438	5,603	7,212	3,684	5,015
	Entertainment	27	4,953	6,719	561	761	609	1,163	1,578	2,073	2,591
	Medical, Legal, Other	28	28,459	31,890	3,519	3,934	3,325	21,636	24,201	6,148	7,278
Local Payments	Local Gov't.	29	42,797	48,100	2,100	2,360	2,016	29,503	33,155	14,049	16,446
	Local Households	30	388,798	426,000	0	0	0	n.a.	n.a.	n.a.	n.a.
Nonlocal Government		32	76,740	100,688	5,600	6,691	4,605	40,182	52,722	7,175	11,449
Total			-	-	38,531	43,274	31,797	388,798	426,000	10,090	13,397

a/ Sector outputs 1-5, 7-15 projected exogenously. Remaining sector output derived from input-output model projection.

The second section of Table 16 shows the effects of variations in fishery output (the fisheries and fish processing sectors). If fishery output turns out to be 50 percent below the 1980 Base Projection, county income would drop $12.5 mil from the Base Projection and employment would drop by about 1,000. This projection represents an absolute decline in the catch from 1969 (13.4 mil pounds per year in 1980 rather than 26.8 mil pounds per year for 1969), perhaps consistent with a situation of no marked technological improvements in the Humboldt County fleet, dock facilities, or fish processing plants. It could also reflect the effect of tighter environmental controls on the allowable catch, or more pessimistically, a depletion in the fishery resource itself, particularly of higher quality species such as salmon.

To provide an idea of the potential impact on the county economy of a substantial (perhaps impossible) increase in fisheries output due to modernization of the industry, the input-output model was run for a case of 100 percent increase in fisheries and fish processing output over the 1980 base projections. This would represent an increase in the catch from 26.8 mil pounds in 1969 to 53.7 mil pounds in 1980. Compared with the 1980 Base Projection, county income would increase by about $25 mil and employment (with technological change) by about 1,600.

The third section of Table 16 shows the impact of variations in the recreation-tourism sector. If recreation-tourism should stay at roughly the estimated 1969 level (50 percent below the 1980 Base Projection) the county income would be about $15 mil less than the Base Projection and employment about 1,800 less. If, on the other hand, recreation-tourism should boom along the lines projected by some recreation specialists (visitor-days in 1980 about four times those in 1969 — the +100 percent of 1980 Base Projection in Table 16), the county income would increase by about $29 mil and employment (with technological change) by about 3,000 over the 1980 Base Model.

Aside from the natural resource based sectors, the major sector in Humboldt County is government. In particular, the level of nonlocal government expenditures (state and federal) in Humboldt County has an important impact on the county's economy. The last section of Table 16 shows the impact of some extreme variations (-50 percent to +100 percent) in nonlocal government output. The effects are dramatic indeed.

If the above sets of projections are reasonably on target, they have important implications for public and private decision making in Humboldt County, as well as decisions by nonlocal government agencies which directly affect the county. Perhaps the clearest implication is that prospective output increases in nonlumber sectors of the Humboldt economy will likely offset decreases in lumber output, but because of prospective technological change throughout the economy, there is little likelihood that employment can be maintained at current levels. Only a fairly massive infusion of nonlocal government spending would maintain employment at the 1969 levels. Of course, other new industries could enter the economy, but there is little in recent history to suggest that firms have found Humboldt County to provide a comparative advantage with respect to other locations. This could change eventually as other coastal sites become more overcrowded and Humboldt "amenity resources" improve in relative attractiveness, but the immediate prospects appear limited for new industry of the type that every community is competing for -- environmentally clean, with strong employment possibilities for locally unemployed, and attraction of high income new employees.

If the above conclusions are warranted, then local planners and agencies face a problem of adjusting local facilities and services to a declining population base. This raises questions of financing schools, roads, etc. for a declining population, perhaps from a smaller tax base. It also suggests a continuing pressure towards local unemployment, with all of the questions which that prospect raises for local and nonlocal government. It suggests that the unemployment problem is likely to be persistent without outmigration, and that training programs and information to encourage local workers to migrate may need examination. It also suggests that unemployment compensation may be one of the larger expenditures by government in the area.

Perhaps the above conclusions are too pessimistic. Several factors could partially ameliorate the bleak employment picture. Perhaps United States rates of increase in output per worker are higher than will be experienced in Humboldt County since technological change in certain industries may arise mainly from construction of new plants, thereby raising the industry average despite constant technology in existing plants. If so, and since lumber is a major and declining industry in Humboldt County, there are fewer chances for technical change through new plant construction. In the short run, this means less job displacement. In the long run, however, it means

that firms which fail to innovate may lose their comparative advantage and close down completely, with even more dire employment consequences. Another possibility to raise employment would be widespread adoption of the 4-day work week. Of course, incomes per worker would not be as high under this policy.

APPENDIX A

Detailed Procedure for Estimating Endogenous Sector Outputs and Total Input-Output Coefficients and Flows

During the spring and summer of 1971, a survey of firms in particular key sectors of Humboldt County was carried out. Initially, it was hoped that the firms could provide information both on their cost structure and on their distribution of sales to other sectors within the outside of Humboldt County. Pre-testing with the questionnaire schedule indicated that firms generally were willing and able to provide a good breakdown of their costs, thus permitting reasonable estimates of their input-output coefficients. On the other hand, information on their distribution of sales to other sectors was fragmentary and contained considerable elements of uncertainty. This experience appears contrary to some other studies where distribution of sales information was more easily obtained and formed the basis of allocating sector output among rows [Peterson and Tiebout, 1964; Hoch and Tryphonopoulous, 1969]. After this initial experience, the schedules were simplified to concentrate on cost information [see sample schedule, Appendix I]. A list of firms in each industry was compiled from various industry sources, and a sample of firms personally contacted by a field interviewer. Where possible, the schedules were completed by the interviewer on the spot. In most cases, however, the schedule was explained and the firms completed it later and returned it by mail. Because of the small number of firms in some sectors, no attempt was made to design the sample statistically. A summary of the responses is as follows:

Sector Group	Number of Firms Contacted	Number of Schedules Obtained	Number of Usable Schedules Obtained
Agriculture	14	11	9
Fishing and Mining	10	10	8
Forest Products	41	26	16
Other Industry	8	1	1
Transportation	7	4	3
Trade	35	13	6
Services	10	3	3
Total	125	68	46

The greatest survey effort was expended on the first three main groupings (agriculture, fishing and mining, and forest products) which were considered the critical resource-based industries of the county. This survey information was combined with secondary data to provide the flows for the input-output tables. Detailed procedures of estimating outputs and flows are outlined for each sector below.

Agriculture (Sectors 1-6)

Sector 1: Field Crops (SIC Codes 0113, 0119, 0123). The field crops sector was defined as field crops (mainly hay) and vegetables harvested for either human or animal consumption. The sector total output figure of $1,233,981 was derived as the total 1969 value of production for field crops (minus pasture) and vegetable crops [Humboldt County Agricultural Statistics, 1970]. The output figure does not include an imputed value for range or irrigated pasture.

The input-output coefficients for this sector were based on cost of production worksheets [University of California, Agr. Ext. Service, 1968a, 1968b, 1970] for each of the main crops (alfalfa, grass-clover hay, and potatoes) included in this sector. The final coefficients represent a weighted average of the coefficients for the individual crops, where relative value of sales were used as weights.

Sector 2: Dairy Farms (SIC Code 0132). The main component of the total sector output of $8,070,524 was the total value of fluid milk sales of $6,974,000 [Humboldt County Agricultural Commissioner's Report, 1970]. The remainder of output was from sales of cull cows, baby calves and sales of replacement cows totaling $1,096,524, based on calculations from cost of production worksheets for grade A and B dairies [Univ. of Calif., Agr. Ext. Service, 1966a, 1966b].

The input-output coefficients for this sector were based on standard production cost surveys on market and manufactured milk [California Bureau of Milk Stabilization, 1970a, 1970b]. The sector coefficients were obtained as weighted averages of market and manufacturing milk coefficients, with relative sales used as weights.

Sector 3: Other Agricultural Production (SIC Codes 01-07 not included in sectors 1 and 2). Total output was calculated as sales of other agricultural products [Humboldt County Agricultural Commissioner's Report, 1970], including the following subdivisions and subsidies:

Fruit and Nut Crops	$ 23,247
Nursery Stock	421,479
Livestock and Poultry	2,882,358
Wool	214,073
Eggs	174,808
Miscellaneous Products	161,932
ASCS Lamb Payment	12,539
ASCS Wool Payment	140,998
ASCS Mohair Payment	56
Total	$4,031,490

An additional ACP payment of $75,254 not clearly identified as to sector of payment was included elsewhere in the table as a payment to households by state and federal government.

The input-output coefficients for this sector were taken as a weighted average (by sales) of coefficients for beef and sheep production derived from cost of production worksheets [Univ. of Calif., Agr. Ext. Service, 1967a, 1967b].

Sector 4: Meat Processing (SIC Code 2011). Total output for this sector is an estimate of total sales. Survey data for meat processing firms gave a ratio of total sales to wages paid; this ratio multiplied by total insured wages in SIC code 2011 [California Department of Human Resources Development, 1969] gave total sector output of $781,358.

Input-output coefficients were based on data from the firms surveyed. The largest coefficient is for beef imports into the county since meat processing in Humboldt County consists primarily of cutting imported slaughtered beef into cuts for consumption. In addition, a very small quantity (less than one percent of total livestock production) is slaughtered in local slaughter houses, consisting mainly of culls, backyard butchering and some boning.

Sector 5: Dairy Processing (SIC Code 202). This sector is defined as the processing of milk into market fluid milk or milk products. Survey

information was obtained from companies employing about half of the labor reported for this SIC sector in Humboldt County. The ratio of wages to sales for the firms surveyed was .08822. Total insured wages for this sector in Humboldt County were $1,284,141 [California Department of Human Resources Development, 1969]. Total sector sales were then calculated as $1,284,141 ÷ .08822 = $14,556,121.

The input-output coefficients for this sector were obtained as weighted averages of coefficients of the firms surveyed, with relative sales used as weights.

Sector 6: Other Food Processing (SIC Codes 203-209, excluding seafood or fish processing). The output for this sector was based upon product per worker and wage sales ratio. The major subdivisions of this sector in Humboldt County are animal and poultry feed production, bakeries, beverages, and miscellaneous food and kindred products. Firm survey information was obtained for the beverage subdivision, and beverage sales estimated by multiplying the survey sales/wages ratio by total insured wages and salaries for this category in Humboldt County [California Department of Human Resources Development, 1969]. For the other subdivision, the United States value of products per worker (U.S. Bureau of the Census, 1969b] was multiplied by the number employed in these subdivisions in Humboldt County. The resulting total sales figure for this sector was $5,805,012.

Since beverages are the major component of this sector in Humboldt County, the input-output coefficients were taken from survey information for beverage firms.

Fishing and Mining (Sectors 7-9)

Sector 7: Seafood Processing (SIC Codes 2031, 2036). Survey information was obtained from all the major fish processing and oyster growing firms located in Humboldt County. The total output of $14,081,750 was, therefore, estimated directly as the sum of outputs of the firms surveyed. The firms estimated that 95 percent of their output is exported from the county. This checks closely with the export figure of $12,712,000 derived as a residual from the flow table.

The input-output coefficients for this sector were taken directly from the cost data provided by the firms surveyed.

Sector 8: Mining (SIC Codes 1311, 1442, 1499). The mining sector is relatively small in Humboldt County with an estimated output of $2,838,000 [U.S. Bureau of Mines, 1969]. The three minerals of commercial value found in Humboldt County are natural gas, sand and gravel, and stone production, with natural gas by far the major component of the total.

The input-output coefficients for this sector were taken as equal to those for the comparable sector of the Washington State input-output study [University of Washington, Graduate School of Business Administration, 1967].

Sector 9: Fisheries (SIC Codes 0912, 0913). The total value (gross) of fish caught by vessels operating out of and selling their products at Humboldt County docks was obtained by personal communication (Gary Smith, Humboldt State College, Marine Extension) and from the California Department of Fish and Game's Regional Offices in Long Beach.

The input-output coefficients for the fishing sector were obtained primarily from costs of production budgets developed by Oregon State University for "typical" single vessels [Oregon State University, 1971] and supplemented by survey data from the firms. According to the survey data and Fish and Game records, the bulk of the catch was purchased by the processors, with the remainder going either to the fishery sector itself for bait or to individual consumers who purchase at dockside.

Forest Products (Sectors 10-15)

Sector 10: Forestry (SIC Code 08). Output for forestry was assumed to be stumpage value; that is, log revenue at the landings minus logging costs. The total estimated production of logs in Humboldt County in 1969 was 1,165,685 board feet [California Division of Forestry, 1971]. An estimated price of $0.0509 per board foot was obtained from survey data on prices paid for logs by sawmills. (This compares closely with the 1969 average of prices paid for timber in Six Rivers National Forest of $0.0514 per board foot.) Thus, the total log revenue was estimated to be $59,333,367.

The input-output coefficients for this sector were derived from the Washington State input-output study [University of Washington, 1967]. Since purchased inputs for this sector are minor, the largest coefficients are returns to primary factor owners (local and nonlocal households).

Sector 11: Logging Camps and Contractors (SIC Code 2411). This sector was considered to consist only of the service of cutting the timber and dragging it to the landings — it does not include transporting the logs from the landings to the mills. The two main methods of logging are tractor yarding and cable yarding, with an estimated distribution of 65 percent of the total cut by the former method and 35 percent by the latter. Logging costs of $15.71 per MBM for tractor yarding and $20.42 per MBM for cable yarding were estimated [U.S. Forest Service, 1971] and the weighted average cost multiplied by the total log output of 1,165,685 MBM (see discussion of sector 10).

The input-output coefficients for this sector were taken entirely from survey data of loggers.

Sector 12: Sawmills (SIC Codes 2421, 2429). The sawmill output was defined as sales of lumber and pulp chips. The total output of $124,188,843 was estimated as a total of the following four components: (1) Redwood output of 467,343,000 board feet [personal communication with the California Redwood Association], 50 percent of which was better grades selling at an average price of $200 per MBM and 50 percent of which was poorer grades selling at an average price of $100 per MBM. (2) Output of whitewoods of 558,156,877 board feet, calculated as the total output of 1,025,499,877 board feet in Humboldt County [Forest Industries, 1971] minus the estimated redwood output. The price of whitewood was estimated from survey data on sawmills to be $0.0745 per board foot. (3) A chip value of $9,914,978 based on survey data from mills. (4) A sales value of $2,704,728 for sawmills included in the field survey but apparently not included in the aggregate output reported in published data. A summary of these components is:

Redwood	$ 69,986,450
Whitewood	41,582,687
Chips	9,914,978
Other	2,704,728
Total	$124,188,843

Since this sector is the largest in Humboldt County, this output figure was estimated in a variety of ways from the many sources of data available. Depending upon the data and assumptions used, output figures of from about $100,000,000 to $130,000,000 were obtained. It is the authors' judgment that the figure of $124,188,843 is the most reasonable of the alternative estimates.

The input-output coefficients for this sector were obtained entirely from field survey and secondary cost data, rather than from existing input-output data.

Sector 13: Veneer and Plywood (SIC Code 2432). The total output of plywood from the five major Humboldt County mills was estimated to be 398,768,000 square feet [Forest Industries, 1971]. From field survey data on sales and production of individual firms, a sales price of $0.0708 per square foot was obtained. Total sales were, therefore, estimated to be $28,232,774. The value of veneer was considered to be negligible.

The input-output coefficients for this sector were obtained from survey data.

Sector 14: Pulp Mills (SIC Code 2611). Estimated total production, price and sales value for this sector were obtained from survey data of the firms involved. These estimates were:

Total Production:	392,574 tons
Price:	$151.21 per ton
Total Value:	$59,360,760

Input-output coefficients for this sector were based on a combination of survey cost data and secondary data including the Washington State input-output table [University of Washington, 1967].

Sector 15: Other Wood Products (SIC Codes 2433, 244, 249). This sector consists primarily of shake, lath, and flakeboard producers. The principal output in dollar terms is assumed to have originated from flakeboard production [Forest Industries, 1971]. The output was directly related to production volume of sawmills in the area since flakeboard is made of sawdust and shavings. Prices for flakeboard [Random Lengths Yearbook, 1969] times this volume gave a sales value of $5,608,916 for flakeboard production. Added to this figure was the total sales of $3,831,159 for companies who responded to the field survey but who did not fit into the sawmill or veneer and plywood sectors. Thus, total sector output was estimated to be $9,540,075.

Input-output coefficients for this sector were obtained from the national input-output table [U.S. Department of Commerce, 1969a].

Other Industry (Sectors 16-18)

Sector 16: Construction (SIC Codes 1511, 1611, 1621, 6560, 1711, 1731, 1701, 1509). The output of this sector is composed of two types of construction, private and government expenditures. The private expenditures on construction were broken down into construction within incorporated cities (the value of which was obtained from building permits issued in each city) and nonincorporated construction (obtained from building permits issued in the county). Government expenditures on construction were divided into three components: local (city and county), state, and federal. The local government expenditures on construction were obtained from the county budget [Humboldt County, 1971] and the budgets for each city; state expenditures were obtained from the individual agencies which operate in Humboldt County; federal expenditures in Humboldt County were obtained from published information [U.S. Office of Economic Opportunity, 1968]. The total output figure for construction, based on the above information, was $17,297,413.

The input-output coefficients for this sector were obtained from the Washington State input-output study [University of Washington, 1967].

Sector 17: Boat Building and Repair (SIC Code 3722). The estimate of output in this sector is based upon information received through interviews with specific firms concerning their operations. Total sales were considered the value of output except for those items which were sold at retail (such as crab pots, fishing lines, nets, and boat equipment) for which only the marketing margin [based on the "miscellaneous Manufacturing Margin" from U.S. Department of Commerce, 1969c, Table B] was used. The estimates are:

Repairs	$132,500
Boat Building	100,000
Retail Margin	254,188
Total Output	$486,688

The input-output coefficients for this sector were obtained from the Washington State input-output study [University of Washington, 1970].

Sector 18: Other Local Manufacturing (SIC Codes 27, 28, 29, 32, 34, 35, 37, 38, 39). The sector includes a wide variety of miscellaneous manufacturing firms. United States gross values of output per worker for these SIC groups were obtained [U.S. Department of Commerce, 1969b] and assumed to be appropriate for Humboldt County. These output per worker figures for each

industry group were then multiplied by the number of employees within each sector [California Department of Human Resources Development, 1969] for Humboldt County. The aggregate output figure so obtained was $19,928,690.

The input-output coefficients for this sector were obtained from the United States input-output study [U.S. Department of Commerce, 1969a].

Transportation (Sectors 19 and 20)

Sector 19: Water Transportation (SIC Codes 4411, 4421, 4422, 4454, 4463, 4469). The output of this sector is primarily cargo handling of exports and imports through Humboldt Bay. The Philadelphia Input-Output Study [Isard, et al., 1966] provided cost figures per ton of cargo handled in an ocean port. Using their figures of $7.97 per ton for general cargo and $1.76 per ton for bulk and tonnage estimates for Humboldt Bay [Humboldt Bay Port Commission, private communication] a value of $7,036,317 was obtained for total cargo handling expenditures. This figure was approximately halved, since cargo handling expenditures within Humboldt County are only half of the total (either loaded or unloaded within Humboldt County). Using this approach, a total output figure of approximately $3,518,158 was obtained. This output figure appears reasonable when checked against the stevedore wage bill for Humboldt Bay.

The input-output coefficients for this sector are primarily from the United States input-output table [U.S. Department of Commerce, 1969a]. However, the wage bill component of local household payments was taken from the stevedore wage bill.

Sector 20: Other Transportation and Warehousing (SIC Codes 4212, 4213, 4214, 4225, 4226, 4231, 4011). The output of this sector consists of revenues derived by trucking companies, railroads, and moving and storage firms located within Humboldt County. Of the 332 trucking firms located within Humboldt County [California Trucking Association, 1970] data on 71 were obtained [California Trucking Association, private communication]. County Business Patterns information [U.S. Bureau of the Census, 1969] indicates that wages constitute 52 percent of total expenses, and profits 3.5 percent of total revenue. Since the total wages paid by the 71 firms is known, their total expenses and total revenue were calculated using these percentages. These 71 firms constitute 21 percent of the trucking firms within Humboldt

County. Assuming that 71 firms are of typical size, a total revenue of $6,537,015 for the trucking sector was determined by dividing their total revenue by 21 percent.

One railroad operates in Humboldt County — the Northwestern Pacific Railroad (NWPRR) which is a wholly owned subsidiary of the Southern Pacific Railroad. According to Southern Pacific officials, total revenue for the NWPRR was $10,770,803 for 1970, of which 85 percent was generated in Humboldt County. Thus, total railroad revenue in Humboldt County was approximately $8,730,182.

For moving and storage firms, gross revenue figures of $313,915 were obtained from the returned questionnaires, which represented about 15 percent of the total number of firms operating within the county. Their sales, divided by the 15 percent, gave an approximation of $2,038,409 for the moving and storage subsector.

Aggregating the three subsectors, a total output of $17,305,606 was obtained for this sector.

The input-output coefficients for this sector were taken primarily from the United States input-output table [U.S. Department of Commerce, 1969a]. However, data from returned questionnaires were used to estimate the principal components of the local household sector (wages and salaries, rent and depreciation).

Trade (Sectors 21-24)

Sector 21: Communications and Utilities (SIC Codes 4811, 4911, 4923, 4941). The output of this sector consists of the aggregated output of the Pacific Telephone Company, the Pacific Gas and Electric Company, and the Humboldt Municipal Water Company. The gross sales of these firms were obtained from returned questionnaires and from the Public Utilities Commission.

The Pacific Telephone Company reported total sales within Humboldt County of $8,126,731 for the year 1970. The Humboldt Bay Municipal Water District's sales were $1,594,213 for the same year. The total sale of gas and electricity within Humboldt County by Pacific Gas and Electric for 1970 was estimated to be $15,837,639.

The input-output coefficients for this sector were obtained from the Washington State input-output study [University of Washington, 1967].

Sector 22: Wholesale and Retail Trade (SIC Codes 50, 52-59). The output of this sector is defined as the value added or gross margin on sales of wholesale and retail firms in Humboldt County. Total retail sales for Humboldt County in 1969 were $182,169,691 [California State Board of Equalization, 1969]. Total retail sales by each subcategory of firm (apparel stores, furniture, etc.) were multiplied by the relevant percentage margins for that subcategory [U.S. Department of Commerce, 1969c] to obtain total margins. The only exception to this was for the "food" subcategory where a lower margin (20 percent rather than 33 percent) was used based on more recent information [Professor Barton DeLoach, University of California, Davis private communication]. Using this procedure, the gross output for retail trade was estimated to be $47,327,784. Wholesale gross output was estimated from the reported labor bill for wholesale trade [California Department of Human Resources Development, 1969], using the same ratio of labor to output in wholesale trade as was obtained for retail trade. The estimated margin figure for wholesale trade was $16,917,174, making the total output for the wholesale and retail trade sector equal to $64,244,958.

The coefficients for this section are from the United States input-output table [U.S. Department of Commerce, 1969a] with the exception that the real estate coefficient from the Washington input-output table [University of Washington, 1967] was used since the definition of real estate output in the Washington study appears more consistent with our own.

Sector 23: Finance and Insurance (SIC Codes 6022, 6025, 6123, 6131, 6312, 6313, 6322, 6323, 6324, 6332, 6333, 6351, 6352, 6411). This sector is composed of three types of financial institutions: banks, savings and loan associations, and insurance companies. Determining the output of this sector involved several major assumptions, given the lack of data, particularly on insurance. Basic information on savings and loan associations, such as net income as a percent of total assets, was obtained from the Federal Home Loan Bank in San Francisco. Information pertaining to banks was obtained from the Bank of America office in San Francisco. Information on insurance was obtained from completed questionnaires that were returned and from the Insurance Information Institute in San Francisco.

The total loans in Humboldt County, broken down by savings and loan associations and banks, were obtained from Humboldt Land Title Company [1960 to 1970, various publications]. Questionnaires were obtained from large representative firms in each category which gave their total loans and assets. Knowing the ratio of the loans of these firms to all loans in Humboldt County, the total assets of savings and loan associations and banks in the county were estimated by assuming all firms had ratios of loans to assets equal to those of the representative firms. The estimated margins for the two types of institutions, obtained from confidential sources, were taken to be five percent of total assets for savings and loan associations and two percent for banks. Multiplying these factors times total county assets gave output figures of $2.6 million for savings and loan associations and $8.4 million for banks.

For insurance, the Insurance Information Institute provided information on the per capita purchases of commercial insurance in California (property and liability), which, when added to personal insurance expenditures (see discussion for Households, sector 30), yields a total insurance expenditure per capita. This figure, times the population of Humboldt County, gave an estimated gross value of sales which, multiplied by the profit margin for all insurance sales in California (.067 obtained as a ratio of net income to earned premiums, personal communication from the Insurance Information Institute), yielded a net output for insurance within Humboldt County of $11,232,416. The estimated total output for the entire sector is, therefore, $22,232,416.

The input-output coefficients for this sector were obtained from the United States table [U.S. Department of Commerce, 1969a].

Sector 24: Real Estate (SIC Code 65). A gross value of real estate transactions of $45,979,000 for Humboldt County was estimated by multiplying property transfer tax for Humboldt County by a conversion factor obtained from the State Board of Equalization.

The output of the real estate sector is considered to be the margin associated with this gross value figure. The real estate margin or service charge was taken to be six percent for developed land and ten percent for undeveloped land. According to the State Department of Real Estate, approximately 20 percent of total real estate transactions fall within the category of undeveloped land, leading to a weighted margin figure of 6.8 percent, and an output figure of $3,126,572.

The output of title abstract companies is estimated by multiplying the number of real estate transactions within Humboldt County (4,501) by $100, the average charge for a title search. This figure ($450,000), when added to the output of real estate firms, yields total output for the real estate sector of $3,576,000.

The coefficients for this sector were taken from the Washington State input-output study [University of Washington, 1967].

Services (Sectors 25-28)

Sector 25: Hotels, Motels and Camps (SIC Code 70). The revenue from hotels, motels, and camps for Humboldt County is estimated to be $4,444,000 [U.S. Bureau of Census, 1967]. Other estimates based on bed-tax information for the major cities and revenues from state parks in the county gave a figure of about $3,500,000. The higher figure from the Bureau of the Census was considered more realistic.

The input-output coefficients for this sector were based on survey information and reported wages and salary data for this sector [California Department of Human Resources Development, 1969].

Sector 26: Selected Services (SIC Codes 721 to 729, 732 to 739, 751 to 754, 762 to 769). Output per worker for each included industry, based on data for the Western United States [U.S. Bureau of the Census, 1967] was multiplied by the number of workers in each industry in Humboldt County [California Department of Human Resources Development, 1969] and the results summed to provide a gross output for this sector of $12,935,000. Input-output coefficients for the sector were derived from the Washington State study [University of Washington, 1967].

Sector 27: Entertainment (SIC Codes 7814, 782, 783, 791, 7929, 793, 7942, 7943, 7945, 7947, 7949). The output value for this sector consisted of expenditures for recreation and entertainment plus expenditures for motion pictures [U.S. Bureau of Census, 1967]. It was assumed that 1963 Bureau of Census expenditure patterns were consistent with 1969 expenditures even though county population dropped slightly during this period. Total estimated expenditures on recreation and entertainment were $1,220,000 and on motion pictures of $793,000. An estimated $3,000,000 for sport fishing

[Humboldt County, 1969b] was also included (as an export) in the output total of $4,953,000 from this sector.

The input-output coefficients from this sector were taken from the United States input-output table [U.S. Department of Commerce, 1969a].

Sector 28: Medical, Legal and Professional Services (SIC Codes 80, 81, 89). This sector consists of medical services (doctors, dentists, and hospitals), legal services (lawyers) and other professional services (accountants, veterinarians). The output of hospitals is defined as the sum of expenditures by hospitals. Data were obtained from questionnaires returned by several hospitals within Humboldt County. The expenditure figures for these hospitals were then expanded to a county total of $21,739,470 based on the ratio of bed capacity in the surveyed hospital to total bed capacity in Humboldt County.

The output for doctors was defined as gross income received. Using an average income for doctors of $35,570 [American Medical Association, 1971] the 102 doctors [Humboldt County telephone book] within Humboldt County earned incomes summing to $3,622,020. For dentists an average income figure of $20,000 was multiplied by the 58 dentists [Humboldt County telephone book] in the county to arrive at a gross income figure of $1,160,000.

For attorneys, accountants and veterinarians, output per employee figures were obtained from the Philadelphia input-output study [Isard, et al., 1966]. Using the Philadelphia study ratio of one employee per professional, totals of 106 employees in legal services, 72 in accounting and 20 in veterinarian services were obtained. The sum of all services yielded a total sector output of $28,506,431.

The input-output coefficients for this sector were based on the Washington study [University of Washington, 1967].

Local Payments (Sectors 29-30)

Sector 29: Local Government. Total output of the local government sector was estimated to be $42,777,000, made up as follows:

Property taxes paid to the county	$ 9,079,000
Other payments to local county governments	2,850,000
Aid from federal and state agencies	12,814,000
Taxes and other payments to cities and special districts	5,752,000
School taxes	12,282,000
Total	$42,777,000

All but the fourth item above are available from the Humboldt County budget [Humboldt County, 1971]. Taxes paid to cities and school districts were obtained from publications of the California State Controller's office [1968, 1969]. The total expenditures of approximately $43 million by local government can be broken down into three general categories: approximately $25 million is expended by the county, $5 million by incorporated cities (Eureka, Arcata, Fortuna, Ferndale, Rio Dell, Blue Lake, and Trinidad) and $12 million by special districts. The bulk of the special district expenditures is on school districts ($11 million) with the remainder being spent on other (mainly protective, e.g., fire) districts. In addition to local government expenditures for education, the state allocates $13 million to school districts. However, in the input-output table this amount is considered as a direct expenditure in the county by nonlocal government.

The column flows and input-output coefficients for the local government sector were estimated from a detailed examination of the expenditures made by county and city governments, and by school districts. A detailed breakdown of county expenditures was available from the county budget [Humboldt County, 1971]. Transfers of funds from state and federal agencies to Humboldt County for distribution (welfare payments, etc.) were included as part of the county's expenditures. Detailed expenditures were available for Eureka, the county's largest city [City of Eureka, 1970]. It was assumed that expenditures by other towns in Humboldt County followed the same pattern.

Sector 30: Local Households. The total output for the household sector is the total personal income for Humboldt County of $388,798,000 [Williams Research Associates, Berkeley, California, as reported in the 1971 California County Factbook. Components for this total are:

Wages and salaries	$209,226,000
Other labor income	12,416,000
Proprietor's income	29,916,000
Property income	43,882,000
Transfer of payments	43,358,000
Total	$388,798,000

The breakdown of the total consumer expenditures by households among various categories was based on a combination of several sources of information. The initial breakdown was based on consumer expenditures in 1961 for urban areas in the West (but outside the SMSA's) with a population of 2,500-50,000 [Bureau of Labor Statistics, 1964a]. While another BLS study [Bureau of Labor Statistics, 1964a] gives consumer expenditures and income directly for Eureka, California and Orem, Utah, certain items appeared to be unreasonable. Therefore, it was decided to update the 1961 BLS study instead.

In updating the 1961 BLS study to a 1969 date, a comparison was made between the Survey of Current Business consumption studies for 1961 and 1969 [U.S. Department of Commerce, 1962, 1970]. The percentage changes in consumption by categories that occurred between 1961 and 1969 were then applied to the corresponding categories of the 1961 BLS study. Thus, it was assumed that consumption expenditures in the BLS report shifted by the same percentage as shown in the 1961-69 Survey of Current Business consumption studies. One additional correction was required. The Survey of Current Business consumption studies include an item of 5.5 percent for "personal business" -- expenditures — an item not included in the BLS report. As a result, the categories of consumption in the BLS study were assumed to total 94.5 percent of total consumer expenditures. The resulting percentage distribution of consumer expenditures is shown in Table A-1. For the main categories of consumption in this table -- such as gifts, religious and welfare activities, tobacco, alcoholic beverages, food, clothing and accessories, etc. -- the percentages of total consumption expenditures were derived from the sources and methods described above. The further breakdown of these categories into subcategories was based on the percentage distribution of subitems within categories taken from the 1969 Survey of Current Business study. The only exception to this procedure is in the food category where the percentage distributions were obtained from a USDA study, Food Consumption of Households in the West [USDA, Agricultural Research Service, 1968].

TABLE A-1

Estimated Percentage Distribution of Household Consumption Expenditures, Humboldt County, 1969

Consumption category	Percentage of consumption expenditure	
Gifts, religious & welfare activities		1.3
Tobacco		0.9
Alcoholic beverages		1.5
Food		20.8
Milk, cream	2.7	
Fats, oils	0.6	
Flour, cereal	0.8	
Bakery products	1.8	
Meat	6.0	
Poultry, fish	1.3	
Eggs	0.6	
Sugar, sweets	0.6	
Potatoes	0.5	
Fresh vegetables	1.1	
Fresh fruit	1.1	
Canned vegetables, fruit	0.8	
Frozen vegetables, fruit	0.2	
Juice vegetables, fruit	0.5	
Beverages	1.1	
Soup, sauce	0.6	
Nuts	0.5	
Clothing and accessories		9.8
Shoes	1.2	
Shoe repair & cleaning	0.1	
Clothing (minus shoes)	7.1	
Cleaning, pressing, alterations, dyeing, laundering in establishments	0.6	
Jewelry and watches	0.6	
Other	0.1	
Personal care		2.5
Toilet articles	1.5	
Barber shops, beauty parlors, baths	1.1	
Housing		28.2
Shelter	12.9	
Household operations	15.3	
Furniture	1.5	
Kitchen & household appliances	1.6	
China, glassware, tableware, utensils	0.7	

(Continued on next page)

Table A-1 continued

Consumption category	Percentage of consumption expenditure	
Other durable household furnishings (radio, television, musical instruments, records)	1.6	
Semidurable household furnishings	1.1	
Cleaning & polishing preparations	1.0	
Stationery & paper supplies	0.4	
Household utilities	4.2	
Electricity	1.7	
Gas	0.9	
Water & sanitary services	0.5	
Other fuel and ice	1.1	
Telephone & telegraph	1.7	
Domestic services	0.8	
Other	0.7	
Medical care		6.8
Drugs	1.0	
Ophthalmic products & orthopedic appliances	0.3	
Physicians	1.9	
Dentists	0.5	
Other professional services	0.3	
Private hospitals & sanitariums	2.3	
Health insurance	0.5	
Recreation		5.3
Books	0.4	
Magazines, newspapers	0.6	
Toys, sport supplies & equipment (boats & pleasure aircraft included)	1.4	
Radio, television, records	1.2	
Radio & T.V. repair	0.2	
Flowers, seeds & potted plants	0.2	
Motion picture theaters	0.2	
Legitimate theater & opera	0.1	
Clubs & fraternal organizations	0.2	
Spectator sports	0.1	
Commercial participant amusements	0.2	
Pari-mutual net receipts	0.1	
Other	0.4	
Transportation		16.3
User-operated transportation	15.3	
New & used cars	7.5	
Tires, tubes, parts	1.0	
Auto repair, parking, washing, greasing	1.7	
Gas and oil	4.4	
Auto insurance	0.7	
Other transportation	1.1	

(Continued on next page)

Table A-1 continued

Consumption category	Percentage of consumption expenditure	
Private education		1.0
Personal business		5.5
Services furnished by financial institutions	2.9	
Legal services	0.6	
Funeral & burial	0.4	
Expense of handling life insurance	1.3	
Other	0.3	
TOTAL		100.0

Total consumption expenditures were estimated to be 83.48 percent of total personal income, derived as follows: Local and federal taxes were assumed to total 11.2 percent of total personal income, based on the 1961 BLS study showing the relationship of money income before and after taxes. The 11.2 percent of income for taxes was further split into 3.85 percent for local taxes and 7.35 percent state and federal tax. The local tax estimate was based on local property and other local taxes estimated from the county budget and from unpublished information obtained from the County Assessor. State and federal taxes were assumed to be the remainder of the 11.2 percent. Savings were estimated at six percent of income after taxes, or 5.32 percent of total personal income, based on the Napa County study [Hoch and Tryphonopoulos, 1969].

To convert this consumption expenditure information into input-output coefficients and flows in the input-output table, each of the consumption items in Table A-1 was allocated to the appropriate output sector. Margins on consumer goods were deducted from consumer items and aggregated to become the coefficient for household expenditures for wholesale and retail trade. Purchases by the household sector for items not produced in Humboldt County were allocated to the import row. The entire expenditure on shelter (aside from a services margin paid to the real estate sector) was considered a payment from households to households either as cash rent or as an imputed rent in the case where the consumer owns his home.

Procedures for Estimating Exogenous Row Sector Coefficients and Flows

In constructing the "total" initial input-output table (i.e., the table showing total input structure of each sector regardless of whether the inputs were locally produced), all noncompetitive imports (imports from sectors not found in Humboldt County) were allocated directly to exogenous import row 31. Exogenous row 32 is the estimated sum of payments by each sector to nonlocal government (essentially federal and state income taxes) plus payments made to nonlocal factor owners (profit, rent, interest, and wages and salaries paid to nonresidents of Humboldt County).

Payments (taxes paid) by households to federal and state government were based on the consumption expenditure study summarized under the household

sector. Federal and state taxes for firms in several other sectors were available from survey information. However, it appeared that federal and state taxes in any particular year were rather erratic among firms in the same sector and from sector to sector. Therefore, it was decided to use the following alternative estimation procedure: Income statements from several representative firms in each sector of the United States economy were obtained from Moody's Industrials for the year 1969-70. Calculations of federal and state taxes as a percent of gross output, as well as net income after taxes as a percent of gross output, were calculated for this set of firms. Based on the former percentage, the federal-state tax payment by a representative firm in each sector was selected as the input-output tax coefficient for that sector.

In sectors where nonresidents of Humboldt County were the principal owners of firms located in Humboldt County (e.g., a chain store or corporation with headquarters outside the county), the estimated income after taxes was considered to be the payment to nonlocal factors. Federal-state tax payments and payments to nonlocal factors were then aggregated for each sector in row 32.

Given the estimates of input-output coefficients for rows 1-29 and rows 31 and 32, the residual in each sector was allocated as a payment to local households. (The residual payment to households also includes depreciation in this table.) Independent estimates of wages and salaries paid in each sector were available from published and unpublished data [California Department of Human Resources Development, unpublished data]. In many sectors, estimates of the other components of local factor payments (rent, depreciation, profit, interest) were also available and used as a check against the imputed residual payments to local households.

A good cross check on the accuracy of the table is the estimate of county personal income implied by the household row. Converting the local household row coefficients to flows (by multiplying the input-output coefficient times the gross output for each sector) and summing over all sectors from 1 through 30, then adding transfer payments to households by federal and state government ($40,182,000) one should theoretically obtain the reported total personal income for Humboldt County of $388,798,000. The household row total obtained in this way was $22,631,000 (about six percent) below the control figure for total personal income. To obtain a balance of row and

column totals it was assumed that the $22,631,000 was a payment to local households from outside the county (wages, profits, interest, rent, etc.), received by residents from economic activity outside the county. This figure appears *a priori* a bit high; however, the alternative would have been to scale upwards the entire household row, with slight distortion of the sector input-output coefficients obtained independently.

Procedures for Estimating Final Demand

Since local governments and local households are endogenous in this study, the components of final demand are federal and state government expenditures in the county and "exports" from the county. (The "export" figure is a residual which includes gross domestic capital formation and inventory changes in this table.)

Total expenditures by nonlocal government in Humboldt County were estimated to be approximately $76.7 million. The bulk of this expenditure is in the form of wages and salaries (payments to households of $40 million) with approximately another $13 million (welfare payments, etc.) transferred to local government. The state's share of the total nonlocal government expenditures is $40.2 million (52 percent) with the rest being expended by the federal government. The state's primary expenditure is for education, with $13 million being allocated to school districts from elementary up through the community college level (College of the Redwoods), and an additional $10 million being expended for the operation of Humboldt State College. In addition, $2 million in federal funds are expended on Humboldt State College. This $12 million expenditure for Humboldt State College comprises 15.6 percent of total nonlocal government expenditures and means that as an economic sector, Humboldt State College would rank seventeenth in importance in the economy, ahead of such prominent sectors as dairies and fisheries. There are many state agencies which operate within Humboldt County, the largest being the Division of Highways, with approximately 275 employees. The Highway Patrol, State Department of Parks and Recreation, Human Resources Development, California Division of Forestry, and Department of Fish and Game all have a substantial number of employees stationed within the county.

A government publication entitled Federal Outlays in California, Vol. I [Clearinghouse for Federal Scientific and Technical Information, 1968

contains an agency (department) breakdown of expenditures by the federal government in Humboldt County. However, the breakdown was not sufficiently detailed to allow easy distribution of expenditures to the various sectors of the input-output table. Where allocation of expenditures was not clear, attempts were made to contact the federal department involved and obtain an approximate percentage breakdown of expenditures by sector. The federal government's share of welfare payments was considered a transaction from federal to local government and then distributed by local government.

There appears to be no comprehensive report showing the breakdown of state expenditures by county. To determine the expenditures by the state in Humboldt County, it was, therefore, necessary to contact all state agencies having offices and/or personnel in the county. The accuracy of state expenditures in the household sector (wages) is excellent, with every state agency furnishing exact payroll figures. In addition, the Department of Education and the Division of Highways had fairly complete figures on expenditures in the other county sectors. However, agencies of lesser importance could supply only estimates of their expenditures for items other than wages. Using the coefficients for Education, values were developed for the other state agencies, based on total operating expenses as provided by the personnel interviewed. As with the federal sector, the state's share of welfare payments was considered to be a transfer to local governments and distributed by local government. Three major publications were used to verify the data provided by personnel from the Departments of Education, Parks and Recreation, and Social Welfare [California State Controller's Office, 1970; California Department of Parks and Recreation, 1971; California Department of Social Welfare, 1971].

The "export" component of final demand for each sector was a residual obtained by subtracting the "requirements" of the endogenous sectors in Humboldt County and the federal-state expenditures from total sector output (Table 10).

Calculation of Competitive Imports and Development of the Final Transactions and Input-Output Coefficient Tables

Table A-2 shows those sectors found locally in Humboldt County, but in which the county is a deficit region and must, therefore, be an importer. It

TABLE A-2

Calculation of Net Exports and Imports from Humboldt County, by Sector, 1969

Sector Group	Sector Description	Sector Number	Total County output	Total County requirements (sectors 1-30)	Final demand from non-local government (sector 32)	Net exports (+) or imports (-)
Agriculture	Field Crops	1	1,234	5,107	0	-3,873
	Dairies	2	8,071	7,000	0	1,071
	Other Ag. Products	3	4,031	5,768	0	-1,737
	Meat Processing	4	781	14,346	0	-13,565
	Dairy Processing	5	14,343	5,910	0	8,433
	Other Food Proc.	6	5,805	22,182	0	-16,377
Fishing and Mining	Seafood Proc.	7	14,082	1,361	0	12,721
	Mining	8	2,838	174	0	2,664
	Fisheries	9	7,338	7,324	0	14
Forest Products	Forestry	10	39,096	39,049	0	47
	Logging	11	20,335	20,178	0	157
	Sawmills	12	124,189	15,929	0	108,260
	Veneer-Plywood	13	28,233	1,539	0	26,694
	Pulp Mills	14	59,361	0	0	59,361
	Other Wood Prod.	15	9,540	3,654	0	5,886
Other Industry	Construction	16	17,797	9,817	7,980	0
	Boat Blding.	17	487	748	0	-261
	Other Local Mfg.	18	19,929	3,451	0	16,478
Trans.	Water Trans.	19	3,518	475	0	3,043
	Other Trans.	20	17,306	14,855	626	1,825
Trade	Comm. & Util.	21	25,559	28,750	291	-3,482
	Wholesale & Retail	22	64,245	75,988	2,670	-14,413
	Finance, Insurance	23	22,232	22,627	4,588	-4,983
	Real Estate	24	3,576	2,880	322	374
Services	Hotels & Motels	25	4,444	344	0	4,100
	Selected Services	26	12,964	30,982	7,182	-25,200
	Entertainment	27	4,953	3,718	0	1,235
	Med., Legal, Other	28	28,459	27,345	106	1,008

was assumed that the required county imports in a given sector were distributed among industries in proportion to their requirements from that sector. The imports of various kinds required by a given column sector were then subtracted from the initial "total" requirements, summed, and added to the import row 30. The endogenous portion of the resulting transactions and input-output coefficient and tables (Tables 11 and 12 shown in the text) show only economic transactions among sectors within Humboldt County.

6/14/73

APPENDIX B

Notes on Solution of Leontief System with Combination Output and Final Demand Projections

Let $\hat{Y}_1^T = \left(\hat{Y}_{11} - - - - \hat{Y}_{1n_1}\right)$ represent final demand projections for m_1 sectors. (T is transpose)

$\hat{X}_2^T = \hat{X}_{21} - - - \hat{Y}_{2m_2}$ are output projections for m_2 sectors

and

$$A = \left(\begin{array}{c|c} \begin{matrix} m_1 \times m_1 \\ A_{11} \end{matrix} & \begin{matrix} m_1 \times m_2 \\ A_{12} \end{matrix} \\ \hline \begin{matrix} A_{21} \\ m_2 \times m_1 \end{matrix} & \begin{matrix} A_{22} \\ m_2 \times m_2 \end{matrix} \end{array}\right) \quad \text{given}$$

with $Y_2^T = (Y_{21} - - - Y_{2m_2})$

and $X_1^T = (X_{11} - - - X_{1m_1})$ unknown .

The transaction equation is:

$$X - AX = Y \tag{1}$$

or

$$\left(\begin{array}{c} X_1 \\ \hline \hat{X}_2 \end{array}\right) - \left(\begin{array}{c|c} A_{11} & A_{12} \\ \hline A_{21} & A_{22} \end{array}\right)\left(\begin{array}{c} X_1 \\ \hline \hat{X}_2 \end{array}\right) = \left(\begin{array}{c} \hat{Y}_1 \\ \hline Y_2 \end{array}\right) . \tag{1a}$$

Expanding (1a) gives:

$$X_1 - A_{11}X_1 - A_{12}\hat{X}_2 = \hat{Y}_1 \qquad (2a)$$

$$\hat{X}_2 - A_{21}X_1 - A_{22}\hat{X}_2 = Y_2 \; . \qquad (2b)$$

Putting unknowns on the left side

$$(I - A_{11})X_1 = \hat{Y}_1 + A_{12}\hat{X}_2 \qquad (3a)$$

$$A_{21}X_1 + Y_2 = \hat{X}_2 - A_{22}\hat{X}_2 \; . \qquad (3b)$$

Equation 3a can be solved by pre-multiplying by $(I - A_{11})^{-1}$

$$X_1^o = \underset{m_1 x m_1}{(I - A_{11})^{-1}} \; \underset{m_1 x_1}{(\hat{Y}_1} + \underset{m_1 x m_2}{A_{12}} \; \underset{m_2 x_1}{\hat{X}_2}) \qquad (4a)$$

and then the solution for X_1 can be substituted into 3b to solve for Y_2

$$Y_2^o = \underset{m_2 x_1}{X_2} - \underset{m_2 x m_2}{A_{22}} \underset{m_2 x_1}{X_2} - \underset{m_2 x m_1}{A_{21}} X_1^o \qquad (4b)$$

X_1^o will be positive with realistic values for $\hat{Y}_1$ and $\hat{X}_2$. Y_2^o may be of either sign. Negative value would imply the need for imports.

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